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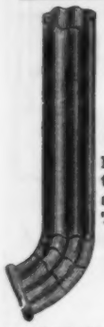

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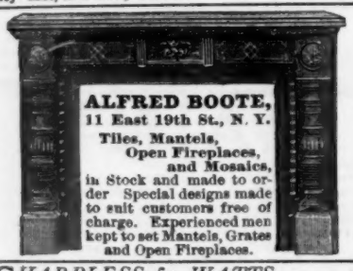

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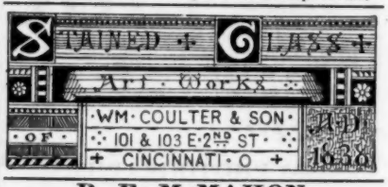

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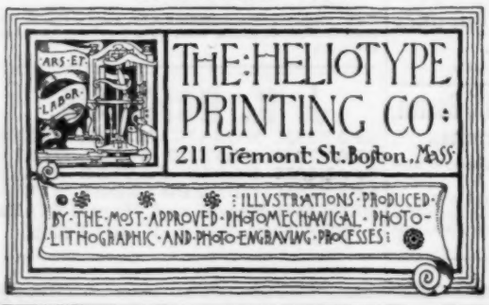

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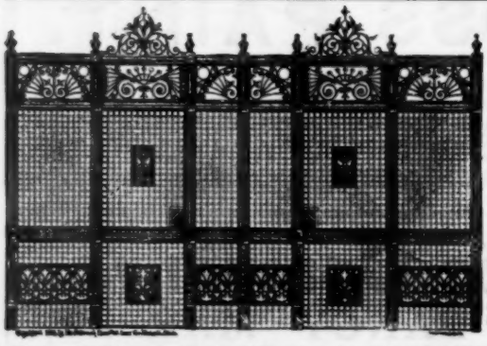

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Keep Your Walls Dry.
A New Cornice Gutter,
In Wood or Metal, set on furs, with a space behind for over-flow water.

Patented May 12, 1885, BY
DUDLEY NEWTON,
ARCHITECT,
Bellevue Ave., Newport, R. I.
Permits to use on any building can be obtained on payment of a royalty of $10. for each. Apply to the Patentee.
Infringements Prosecuted.

SETH THOMAS CLOCK CO.,
THOMASTON, CONN.
20 MURRAY ST., NEW YORK,
TOWER CLOCKS.
SEND FOR CATALOGUE.

McSHANE BELL FOUNDRY

Manufacture those celebrated Bells and Chimes for Churches, Tower Clocks, &c., &c. Prices and Catalogues sent free.
Address
H. McSHANE and CO.,
Baltimore, - - - Md.

The Temporary Binder
Provided by us will keep your copies of the *American Architect* in PERFECTLY uninjured condition.
Price $1.25, post paid

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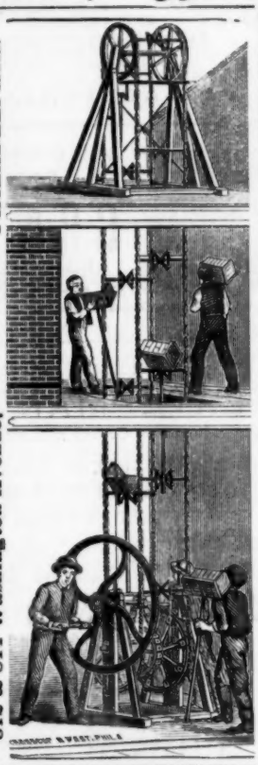
E. BREWER,
Hydraulic, Steam, Belt, and Hand
ELEVATORS, For Freight and Passengers.
267 Federal St., Boston. 149 Broadway, New York.
Send for Circular.

M. B. SWEZEY,
Manufacturer of
IMPROVED DUMB-WAITERS
For Dwellings, with Automatic Catch.
120, 20th St., Chicago, Illinois.

SMITH & NICHOLSON PATENTS.
Something New in HOD ELEVATORS.
50,000 Bricks and the required Mortar per day on 7th Story—The Speediest, Cheapest, Safest method of Elevating Material Known. *Send for circular to*
THE NATIONAL HOD ELEVATING CO., (LIMITED.)
812 & 814 Washington Avenue, - - - PHILADELPHIA.



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LIMITED. TROY, N. Y.
Salesrooms: New York and Chicago.

The most complete line of machinery for hotels and Public Institutions. Complete laundries for Institutions our specialty.
Estimates furnished. Send for Illustrated Catalogue.

American Fire Insurance Co., Phila.

CASH CAPITAL	400.000.00
Reserve and Liabilities	1,070,610.93
Surplus	447,821.13
Total Assets Jan. 1, 1886.	1,918,431.05

WIRE LATHING,

ESPECIALLY ADAPTED TO
Public Buildings, Private Residences, Mills, Warehouses, Stores, and all Mercantile Structures.

☞ IT IS POSITIVELY FIRE-PROOF. ☜

WIRE LATHING possesses the following qualities:

IT IS NOT COSTLY.
IT IS EASILY AND CHEAPLY APPLIED.
PLASTERING ON THE WIRE LATH WILL NOT CRACK.
THE LATH WILL NOT CORRODE.

The plastering, when applied, **clinches** on both sides of the wire, **forming a double surface.**
THE WIRE LATHING is extensively used by the United States Government in its Custom House, Court House, and Post Office Buildings.
It is indorsed by the leading Insurance Companies, who have applied it to their own fine edifices.
Full information given on application to the

CLINTON WIRE CLOTH CO., Clinton, Mass.
59 Beekman Street, New York. **137 Lake Street, Chicago.**

NATURAL WOOD FINISHING.

Good taste and artistic appreciation demand the preservation of Nature's colors in finishing the interior wood-work of your house, therefore, use only

BERRY BROTHERS'

HARD OIL FINISH,

which preserves, heightens, and brings out the natural color of all woods. For the interior wood-work of *public buildings* and *private houses* this article has never been equalled, always maintaining its standard character amid the many so-called imitations its success has brought upon the market. See that every package bears our brand or label. Samples finished wood furnished on application.

BERRY BROTHERS, Varnish Manufactur's, Detroit.
For outside doors use Berry Brothers' "ELASTIC OUTSIDE FINISH."

BUILDING MATERIALS.

Reported for the American Architect and Building News.

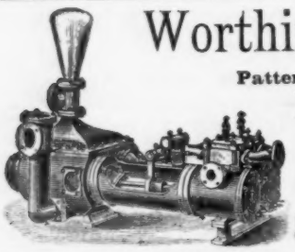
BRICK.—₱ M.	New York. (Wholesale Prices.)	Boston. (Prices to Builders and Contractors.)	Chicago.	Philadelphia
Common: *Cargo afloat.*				
Pale	$4 00 @ $4 50	Eastern 7 50 @ 8 00	Building Brick 9 00 @ 10 00	Sq. Hard @ 10 00
Jersey	6 25 @ 6 75	Bay State Hard 9 50		" @ 8 00
Long Island				Salmon @ 6 00
Up River	7 00 @ 7 50	Domestic Com. 9 00 @ 9 50	Indiana Pressed 16 00 @ 22 00	Sq. " @ 8 00
Haverstraw Bay	7 25 @ 7 50	Domestic Face 19 00 @ 20 00	St. Louis Fronts @ 27 00	Light Stretchers @ 10 00
" 1st	7 50 @ 8 00	Philadelphia 40 00 @ 45 00		Medium " @ 11 00
Hollow	@ 13 00	Phila. mould 50 00 @ 80 00		Red " @ 12 00
Fronts:				Dark " @ 14 00
Croton, Brown	12 00 @ 14 00		22 00 @ 29 00	Pressed 22 00 @ 24 00
" dark	12 00 @ 15 00		65 00 @ 350 00	Best Paving @ 15 00
" red	12 00 @ 15 00		@ 50 00	Second " @ 12 00
Chicago pressed		Glens Falls 25 00 @ 26 00	@ 45 00	Third " @ 11 00
Chicago Moulded			38 00 @	
Baltimore	37 00 @ 41 00	Glens Falls Mould. 30 00 @ 35 00	25 00 @	
Glens Falls—white	30 00 @ 35 00	35 00 @ 40 00	60 00 @ 100 00	
Philadelphia	24 00 @ 25 00	45 00 @ 60 00	30 @	
Trenton	24 00 @ 25 00		35 @	
Milwaukee			55 00 @ 65 00	
Moulded:				
Clark's Glens Falls—Red	25 00 @ 27 00			
" —White	30 00 @ 35 00			
White " Mold,	45 00 @ 60 00			
Enamelled: *Imp.*				
Enamelled (edge.)	85 00 @ 100 00	@	@ 100 00	Dom. @ 65
Enamelled (edge and end)	90 00 @ 115 00	@	@ 120 00	@ 85
CEMENT, LIME, etc.—(₱ *cask.*)				
Rosendale Cement	1 00 @ 1 10	@ 1 50	*Not Sold.*	1 15 @ 1 50
Louisville "			1 05 @ 1 30	Book, Shoobridge 2 85 @ 3 25
Utica, Akron, Buffalo, Milw'kee.	*Not sold.*	*Not sold.*	1 00 @ 1 25	2 85 @ 3 25
Portland, English (Gibbs)	2 50 @ 3 10	@ 3 00	3 25 @ 3 40	2 85 @ 3 25
" " (K. B. & S.)	2 75 @ 3 10		3 25 @ 3 50	2 85 @ 3 25
" " (Burham)	2 50 @ 2 80		3 15 @ 3 35	2 85 @ 3 25
" " (White's)	2 65 @ 3 00			
" French (Lafarge)	3 50 @ 4 50	*Not sold.*	3 75 @ 4 25	Hemmoor 2 85 @ 3 25
" German (Alsen)	2 75 @ 3 15	3 00 @ 3 50	3 25 @ 3 50	2 65 @ 3 00
" " (Fewer)	2 45 @ 2 70	3 15 @ 3 35	3 15 @ 3 35	Josson 2 65 @ 3 00
" " (Vorwohler)	2 50 @ 3 25		3 00 @ 3 25	2 85 @ 3 25
" " (Lagerdofer)	2 25 @ 2 55	*Not sold.*	3 00 @ 3 25	2 85 @ 3 25
" " (Dyckerhoff)	2 75 @ 3 15	3 00 @ 3 50	3 25 @ 3 50	2 80 @ 2 75
" " (Hanover)	2 50 @ 3 00		*Not Sold.*	3 00 @ 3 50
" American (Saylor's)	2 15 @ 2 30	2 15 @ 2 50	2 75 @ 3 00	6 50 @ 7 00
Roman	2 75 @ 3 00	@ 3 20	2 75 @ 3 25	11 50 @ 12 00
Keene's coarse	5 00 @ 6 50	@ 7 50	7 00 @ 7 50	
" superfine	8 75 @ 11 00	@ 11 50	11 00 @ 12 00	
Lime:			*Not sold.*	White Lime 28 @ 85 ₱ bush.
Lime of Teil	@ 5 00			White Mash 1 25 @ 1 50
Hydraulic Lime	@ 1 45	@ 145	60 @ 65	1 00 @ 1 00
Chicago Lime in bulk			75 @ 85	
Wisconsin "				
Rockland and Rockport, (Com.)	@ 1 00	@ 1 15	*Not sold.*	*Not sold.*
Rockland and Rockport, finish.	@ 1 20	@ 1 20	*Not sold.*	*Not sold.*
State, com. cargo rates (nom.)	@ 90	*Not sold.*	*Not sold.*	*Not sold.*
State, finishing "	@ 1 10	*Not sold.*	*Not sold.*	*Not sold.*
Plaster of Paris (calcined.)	@ 1 25	1 65 @ 1 90	@ 1 75	1 25 @ 2 25
" (casting)	@ 1 45	@ 2 25	@ 1 75	1 75 @ 2 50
Hair (Cattle) ₱ *bush*	@ 25	@ 30	20 @ 25	22 @ 30
" (Goat)	30 @ 35	@ 30	35 @ 40	30 @ 35
Sand, ₱ *load*	1 00 @ 1 25	1 00 @ 1 75	100 @ 1 25	@ 1 50
STONE. (₱ *cubic foot, rough.*)				55 @ 65
Granite: (*Maine*)		@ 60		
Limestone:				
Bedford	@ 1 00	95 @ 1 00	50 @	80 @ 90
Joliet	@		33 @ 55	
Lemont	@		35 @ 60	
Serpentine	@		80 @ 90	4 50 ₱ Perch.

(Continued on page vi.)

ATLANTIC WHITE-LEAD & LINSEED-OIL CO.,
MANUFACTURERS OF
"ATLANTIC"
PURE
WHITE LEAD,
—AND—
Pure Linseed-Oil,
Raw Refined and Boiled.

ATLANTIC WHITE LEAD — PURE — WARRANTED — ROBERT COLGATE & Co. — TRADE MARK

The best and most reliable
White-Lead made,
And unequaled for
Uniform
Whiteness,
Fineness,
and Body.
Robert Colgate & Co.,
287 PEARL ST., NEW YORK.



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Patterns specially adapted to
HOUSE TANK SERVICE
And Hydraulic Elevators.
ABSOLUTELY NOISELESS.
HENRY R. WORTHINGTON - New York.
BOSTON, CHICAGO, ST. LOUIS, CINCINNATI,
CLEVELAND, SAN FRANCISCO, PITTSBURGH.

BUILDING MATERIALS.

	New York. (Wholesale Prices.)	Boston. (Prices to Builders and Contractors.)	Chicago. (Prices to Builders and Contractors.)	Philadelphia. (Prices to Builders and Contractors.)
Foundation:				
Dimension	@	5 00 ₱ ton	20 @ 28	1 45 @ 2 50
Block	@	4 60 ₱ perch	8 50 ₱ cord.	Conshocken
Rubble	@	1 25 @ 1 50	8 50 @	1 45 @ 2 50
Bluestone: (₱ *sq. ft.*)				
Sidewalk	30 @ 5 00	40 @ 1 75	75 @ 1 00	1 in. th. 10 @ 19
Planed	50 @ 6 00	75	50 @ 1 00	37 @ 45
Sandstone.				
Longmeadow	@ 80	80 @ 90		1 05 @ 1 15
Kibbe	@ 90	90 @ 1 10		1 05 @ 1 35
Brown (Connecticut)	1 00 @	1 25 @ 1 45	1 50 ₱ cub. ft.	
Amherst, Ohio	90 @ 95	85 @ 95	55 @ 65	80 @ 1 00
Berea, Ohio	75 @ 1 00	80 @ 90	45 @ 55	
Berlin, Ohio	75 @ 1 00	80 @ 90	55 @ 65	
Belleville	80 @ 1 25	1 25 @ 1 35	"	1 10 @ 1 40
New Brunswick and Nova Scotia	@ 1 00	75 @ 90	"	1 00 @ 1 10
Caen	@	@ 2 00	"	1 15 @ 1 50
Marble (₱ *cu. ft.*)				
Lee, Mass	@	1 75 @ 2 50	*Not sold.*	2 00 @ 2 50
Rutland, white	@	@ 3 00	3 50 @ 5 00	2 25 @ 2 50
Sutherland Falls	1 25 @ 1 75	@ 2 00	3 50 @ 5 00	1 75 @ 3 00
Glens Falls, black	@	2 00 @ 3 00	*Not sold.*	4 00 @ 4 50
Italian, blue-veined	@	50 @ 60	@ 4 40	2 50 @ 2 75
" Sienna	@	3 00 @ 3 50	*Not sold.*	@ 5 00
Tennessee, red	@	1 25 @ 2 50	@ 4 40	4 00 @ 6 00
" Knoxville	@	85 @ 90	@ 4 40	3 00 @ 4 00
Pennsylvania, blue	@	@	*Not sold.*	2 00 @ 3 00
Vermont, white	@	1 50 @ 2 00	3 50 @ 5 00	2 25 @ 3 00
Slate: Roofing (₱ *square*)				
" green	7 00 @ 8 00	4 50 @ 7 00	6 25 @ 8 10	5 00 @ 7 00
" " unfading	@ 5 75	@ 5 75		5 00 @ 7 00
" purple	7 00 @ 8 50	5 50 @ 6 50		@ 11 00
" red	@ 15 00	13 00 @ 14 00	—— @ 16 00	@ 11 00
" black, Lehigh	—— @ ——	Brownville, Me.	7 20 @ 7 60	@ 3 00
" " Chapmans	—— @ ——	6 50 @ 9 00	7 30 @ 8 00	@ 5 35
" Unfading Black, Monson, Me.	5 50 @ 8 00	5 50 @ 8 00	6 00 @ 8 50	@ 5 35
Tiles, Am. ₱ M.	@		*Not sold.*	@ 27 00
N. Peach Bottom, warranted unfading				@ 7 00
PAINTS. (*In oil,* ₱ *lb.*)				
White lead, Am.	7 @ 7¼	7 @ 7½	6½ @ 7	@ 7
" Zinc, "	5 @ 8½	@ 8	7 @ 10½	@ 7¼
Red lead, Am.,	6 @ 6½	6 @ 6½	6½ @ 6½	@ 7
" Venetian	6 @ 10½	7 @ 12	1½ @ 2½	dry Eng. @ 1½
" Vermilion	65 @ 70	55 @ 60 dry	55 @ 60	Eng. @ 18
Red Indian, Eng.	12 @ 20	12 @ 20	12 @ 20	@ 9
Yellow Ochre	6 @ 15	7 @ 12	3 @ 15	dry Am. @ 1½
" Chrome	12 @ 20	18 @ 25	15 @ 25	@ 20
Green (chrome)	8 @ 13	8 @ 20	10 @ 20	@ 20
Green, Paris,	25 @ 40	25 @ 40	18 @ 35	" @ 20
Black, lamp,	15 @ 25	15 @ 25	8 @ 30	@ 16
Blue, ultramarine	12 @ 18	18 @ 30	12 @ 35	@ 20
Oil, linseed, (raw) (₱ gal.)	43 @ 45	43 @ 43	42 @ 43	@ 45
" " boiled	46 @ 47	46 @ 48	45 @ 46	@ 48
Turpentine	47½ @ 48½	46 @ 49	@ 53	@ 40
Varnish, coach	@	1 50 @ 6 00	1 25 @ 2 00	@2 25
Shellac	@	2 50 @ 3 00	3 25 @ 4 00	@2 90
Putty	2 @ 3	2 @ 4	02 @ 02½	@ 2
Whiting	50 @ 65	1 @ 1½	1 @ 2	@ 1
Paris white, (Eng.,) (dry)	2 @ 3	2 @ 3	2 @ 2½	@ 1½
Litharge, Am	5½ @ 5½	6½ @ 7	6½ @ 6½	@ 7
Sienna (burnt)	12 @ 17½	14 @ 20	4 @ 16	@ 16
Umber, "	11 @ 16½	14 @ 20	2 @ 10	@ 14
HARDWARE.				
Nails: (*Per Cask.*)			3 50 @	per keg @ 2 90
Spikes, (*wrought.*)	@ 2 50		@ 2 50	@ 2 65
10d. common	@ 2 35	@ 2 50	@ 3 25	@ 3 15
Shingle	@ 3 00	@ 3 25	@ 5 50	@ 5 25
Lath	@ 4 53	@ 4 75	Add $1 50	per lb 11 @ 14
(*Finishing nails according to size.*)				Add 1 00 pr cask
(*For casing nails add 75c. per keg.*)				
Butts: 4"x 4" (₱ doz. pairs.)				
Plain	@ 1 00	@ 1 20	65 @ 1 00	@ 1 16
Japanned	@ 1 50	@ 1 75	*Not sold.*	1 75 @ 2 00
Acorn, Japanned	@ 1 50	@ 2 50	2 00 @ 3 75	1 75 @ 2 00
Acorn, Boston finish (₱ pair.)	@ 65	@ 75	*Not sold.*	@ 50
Bronze metal	@ 1 90	plain 2 25	2 00 @ 3 25	@ 1 37
Brass (for cupboards)	@ 10	@ 10	@ 12	@ 1 00
Ebony				@ 35
Apple wood				37 @ 1 00
Knobs: (₱ *Set.*)				
Mineral, best	@ 8	@ 10	8 @ 10	@ 08
Lava	@ 50	@ 75	65 @ 80	*Not sold.*
Hemacite	*Not sold*	17 @ 38	31 @ 40	25 @ 50
Porcelain	@ 30	@ 12	25 @ 30	@ 30
Glass, solid	*Not sold*	@ 75	*Not sold.*	1 75 @ 2 00
Glass, silvered	*Not sold*	88 @ 1 50	@ 1 50	1 75 @ 2 00
Bronze metal	75 @ 2 00	88 @ 2 00	75 @ 2 50	50 @ 3 50
Brass	1 00 @ 2 50	88 @ 2 00	1 50 @ 3 00	50 @ 3 50
Solder:		16 00 @ 17 00	13 00 @ 15 ℅	22 @ 35
Iron:				
I-Beams up to 12"	@ 3	@ 3	@ 4	30 2½ @2½
I-Beams above 12"	@ 3	@ 3	@ 4	
Channel-Beams up to 12"	@ 3	@ 3	@ 4	

(*Continued on page* vii.)

Heating Apparatus.

OUR HOMES
HOW TO HEAT & VENTILATE THEM.

New Edition of 96 pages, with additional matter, and illustrations of 45 of the finest residences in the country. A complete Manual on the subject of Sanitary Heating and Ventilating, besides giving valuable suggestions to those who are building or furnishing a home. The book is exceedingly artistic, and will be mailed free on receipt of 6 cents in stamps
SMITH & ANTHONY STOVE CO., Boston, Mass

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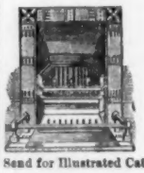
DEALER IN
Mantels and Grates,
Brass Fire-places, Tile Hearths and Facings, Brass Fenders, Andirons, Fire-sets, Coal-Hods, Etc.
Wood Mantels a specialty.
178 WABASH AVE., CHICAGO.

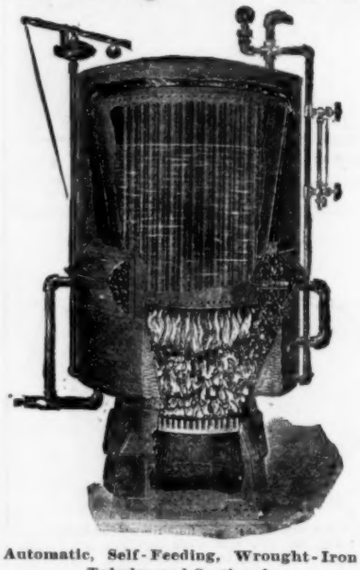
J. REYNOLDS & SON,
FURNACE MANUFACTURERS.
Kitcheners, Grates, etc.
Send for Catalogue.
PHILADELPHIA, PA.



W. H. HARRISON & BRO.,
Manufacturers.
PLAIN AND ARTISTIC
GRATES
AND FIREPLACES
A SPECIALTY.
Also, **Furnaces and Ranges.**
Send for Illustrated Catalogue. 1435 Chestnut St., Philadelphia.

MANUFACTURER OF
SLATE MANTELS,
Heaters, Grates and Ranges.
MATTHEW HALL,
1927 & 1929 Market Street,
PHILADELPHIA, PA.

GORTON'S Latest Improved
House-Heating Steam-Generator,



Automatic, Self-Feeding, Wrought-Iron Tubular and Sectional.
ECONOMICAL IN THE USE OF FUEL.
The coal reservoir (see cut) surrounds the lower outer surface of the boiler, and will hold enough coal to keep up a steady fire and steam for from twelve to twenty-four hours without re-filling.
The coal will steadily feed down from the outer surface and distribute itself at a very uniform depth over the surface of the grate, as it is needed.
It is also very easy to get at the fire and to clean the grate without dumping it.
No brick or mason work required in setting.
Send for illustrated catalogue giving full description and prices.
GORTON BOILER MFG. CO., 110 Centre St., New York.

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The GOODWIN GAS STOVE & METER CO.,
MANUFACTURERS OF
The Sun Dial Gas Cooking and Heating Stoves.

The most economical in use. Over 100 different kinds. Suitable for Families, Hotels, Restaurants and Public Institutions. Laundry, Hatters' and Tailors' Heaters. Hot-Plates, Warming-Closets for Pantries. Hot-Water Generators, etc., etc.

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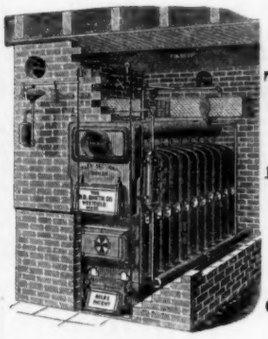
Waldo Bros., Agts., 88 Water St., Boston, Mass.



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MANUFACTURERS OF
The Union Steam and Water
HEATING APPARATUS,
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Also Manufacturers of
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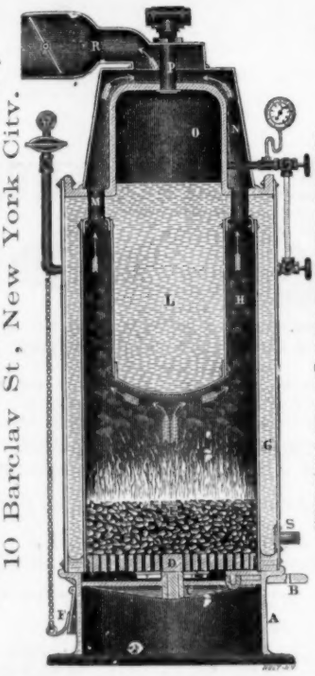
10 Barclay St., New York City.



Steam Heaters for Public Buildings, Private Dwellings, Schools, etc.
Send for Illustrated Catalogue and Price-List.

ST. LOUIS
Steam Heating and Ventilating Co.,
CONTRACTORS FOR
HEATING BY STEAM
Stores, Residences, Churches, and all Public Buildings. Plans, Specifications and Estimates furnished.
No. 621 OLIVE STREET, ST. LOUIS, MO.

SHIELDS & BROWN,
78 & 80 Lake Street, - Chicago, Ill.
MANUFACTURERS AND SOLE PROPRIETORS OF
BRADLEY'S

FOR BOILERS AND STEAM PIPES.
Reduces Condensation of Steam.
FOR GAS AND WATER PIPES.
Prevents Sweating and Freezing.
The best Non-Conductor of Heat and Cold in the World.
Send for illustrated descriptive Circular, and name this paper.
132 Cedar Street, New York.

STEAM WARMING.
BATES & JOHNSON,
114 LEONARD STREET, - - - - - - NEW YORK.
59 West Water Street, Syracuse. 310 Broadway, Albany.
House Warming a Specialty. Estimates Furnished on Application.

REGISTERS MADE TO ORDER FROM THE SPECIAL DESIGNS OF ARCHITECTS.
Manufacturers of Warm-Air Registers, Ventilators, Ornamental Screens, Etc.
The Tuttle & Bailey Mfg. Co.,
64 Union Street, Boston, Mass.
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SLATE MANTELS
Of the latest and most beautiful designs, and all other Slate and Soapstone work on hand or made to order. Joseph S. Miller & Brother, 1210 Ridge Avenue. Philadelphia, Pa. Successor to Wilson & Miller. Send for Illustrated Price-List.

THE FLORIDA
House - Heating Boiler.
(Catchpole's Improved.)
The cheapest and most economical Low-pressure Steam Boiler in use. Illustrated Catalogue free.
The FLORIDA BOILER WORKS, Geneva, N. Y.

BUILDING MATERIALS. LUMBER.—₱ M.	New York. (Wholesale Prices.)	Boston. (Prices to Builders and Contractors.)	Chicago.	Philadelphia.
Boards: (*Ordinary dimensions.*)				
Pine, 1st quality, clear	65 00 @ 75 00	50 00 @ 60 00	46 00 @ 48 00	55 00 @ 60 00
" 2d quality	55 00 @ 60 00	42 00 @ 48 00	44 00 @ 46 00	40 00 @ 50 50
" 3d quality	18 00 @ 22 00	35 00 @ 40 00	43 00 @ 45 00	15 00 @ 30 00
Spruce	@ 25 00	13 00 @ 15 00	*Not sold.*	@ 35 00
Hemlock	ea. 17 @ 18	12 00 @ 13 00	@ 10 00	@ 14 00
Yellow pine	20 @ 40	25 00 @ 40 00	@ 28 00	20 00 @ 50 00
Cypress	@	32 00 @ 40 00	@	40 00 @ 45 00
Clapboards:				
Pine	@	33 00 @ 55 00	10 50 @ 22 00	20 00 @ 35 00
Spruce	@	23 00 @ 35 00	*Not sold.*	*Not Sold.*
Framing Timber:				
Pine			12 00 @ 17 00	28 00 @ 32 50
Spruce	13 50 @ 16 00	13 50 @ 16 00	*Not sold.*	20 00 @ 22 50
Hemlock	12 00 @ 15 00	@	10 50 @ 15 50	12 50 @ 13 50
Yellow pine	18 00 @ 25 00	25 00 @ 30 00		26 00 @ 28 00
Laths:				
Pine	1 90 @ 2 15	2 25 @ 2 35	1 75 @	@ 3 00
Spruce	@	2 25 @ 2 50	*Not sold.*	@ 2 75
Shingles:				
Pine, shaved ₱ M.	5 00 @ 6 00	@	*Not sold.*	
Pine, sawed "	4 00 @ 5 50	@ 4 50	2 40 @ 2 60	
Spruce, sawed "	1 50 @ 2 00	1 50 @ 2 00	*Not sold.*	
Redwood ₱ 125	1 40 @ 1 60	3 75 @ 4 50	5 50 @ 8 00	30" $10 @ 28
Cedar, split ₱ M.	@	@	*Not sold.*	24" 8 @ 21
Cedar, sawed "	@	2 00 @ 4 00	2 25 @ 2 35	20" 5 50 @ 14
Cypress. Split...7 x 24. "	18 00 @ 20 00	5 50 @ 6 00	4 00 @ 4 50	13 00 @ 20 00
Miscellaneous:				
Piles ₱ ft.	4½ @ 5½	Piles 6c. ₱ ft.	*Not sold.*	
Fence pickets, Spruce	8 00 @ 10 00	10 00 @ 18 00	Pine, 8 @ 21 00	12 00 @ 14 00
Cedar posts, 9 ft. (sq. posts.)	@	25 @ 35	9 00 @ 21 00	70 @ 1 25
Chestnut "	@	25 @ 35	*Not sold.*	28 @ 36
Finishing Woods: ₱ M. (*First Quat. Kiln-dried.*)				
Ash	@ 55 00	38 00 @ 48 00	35 00 @ 40 00	35 00 @ 50 00
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Mahogany, Baywood [Mexican]	@ 180 00	150 00 @ 160 00	150 00 @ 180 00	150 00 @ 250 00
" St. Domingo	@ 350 00	120 00 @ 350 00	250 00 @ 300 00	200 00 @ 300 00
Maple	45 00 @ 50 00	45 00 @ 60 00	30 00 @ 35 00	27 50 @ 55 00
Oak, red	@ 70 00	@ 50 00	35 00 @ 40 00	35 00 @ 45 00
" white	@ 70 00	50 00 @ 55 00	35 00 @ 40 00	40 50 @ 50 00
" quartered	@ 90 00	65 00 @ 70 00	45 00 @ 50 00	57 50 @ 67 50
Sycamore quartered		50 00 @ 65 00	40 00 @ 50 00	57 50 @ 67 50
Pine, clear	65 00 @ 70 00	3[illegible] @ 65 00	45 00 @ 50 00	@ 65 00
Redwood	60 00 @ 70 00	60 00 @ 70 00	56 00 @ 65 00	72 50 @ 75 00
Rosewood ₱ lb	@ 6	@	@ 7	
Walnut, black	125 00 @ 150 00	85 00 @ 120 00	80 00 @ 100 00	90 00 @ 200 00
Whitewood	45 00 @ 50 00	38 00 @ 45 00	30 00 @ 35 00	25 00 @ 45 00
Yellow pine ₱ M	@ 45 00	40 00 @ 45 00	30 00 @ 35 00	37 50 @ 45 00
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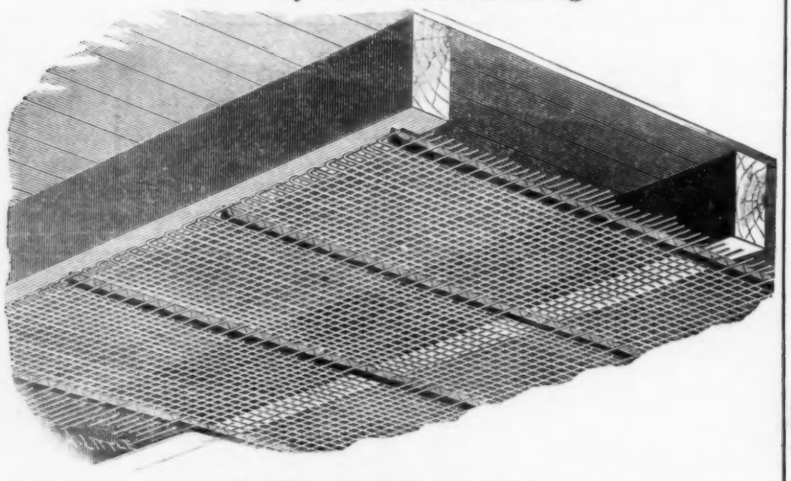

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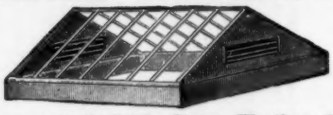

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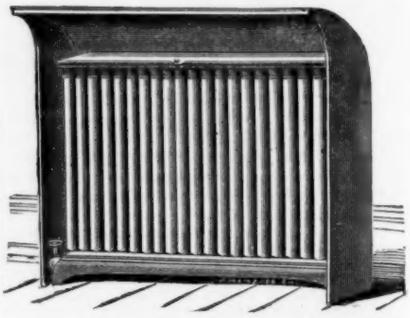

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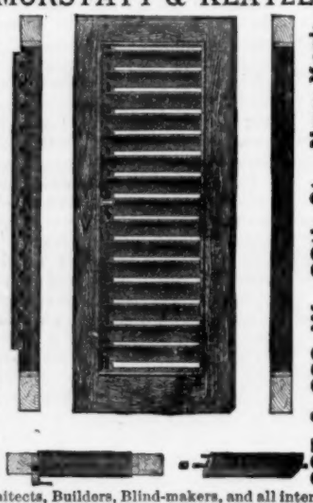

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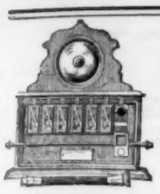

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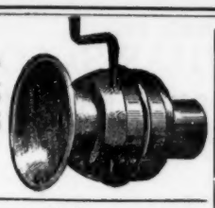

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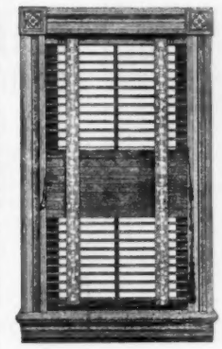

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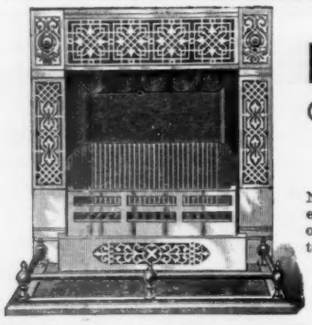

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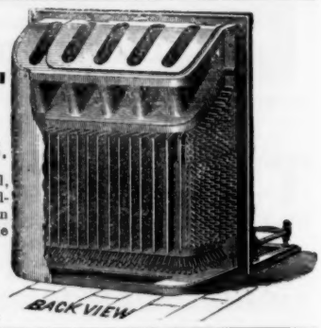

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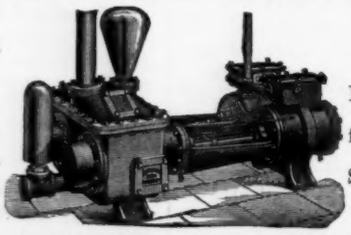

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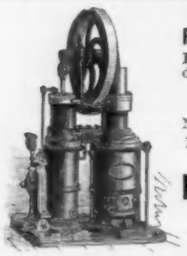

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CONSIDERING the variety and seriousness of the risks to which mills, filled as they are with valuable but combustible materials, are exposed, it is almost surprising that anyone should be found courageous enough to insure them. During the past year, which was an unusually favorable one, eighty-six fires occurred in the seven hundred and fifty factories or other buildings insured in the Boston Manufacturers' Mutual and the Spinners' Mutual Companies, or in nearly twelve per cent of the whole. Yet the loss in all these fires put together was only thirty-four thousand dollars, or about one twenty-fifth of one per cent on the amount at risk. It would seem, at first sight, that, independent of the risks from friction of machinery, spontaneous combustion, and so on, a fire in a cotton or woolen mill, consisting of a few immense rooms, through which a fire could spread rapidly by jumping from loom to loom, must be usually much more destructive, in proportion to the size and value of the building and its contents, than a fire in a dwelling-house, divided by plastered partitions into a great number of small rooms, most of which would contain comparatively little combustible material, and a generation ago this was the opinion of underwriters who, we believe, usually demanded a premium of two per cent a year for insuring a cotton-mill, and considered them unprofitable risks even at that rate. An insurance agent of that time, who should have predicted that in thirty years a premium of one-fiftieth of that amount would, exclusive of the cost of managing the business, be found sufficient to cover the fire losses in a hundred million dollars' worth of such buildings, without any costly change in the method of constructing or carrying them on, would have been looked upon as a madman, and we doubt if even the officers of the factory mutual companies themselves quite appreciate the extraordinary work that they have accomplished. To put the matter in a different way, let us suppose that some enterprising person should make a contract with the owners of a hundred million dollars' worth of shoe-factories, paint-shops, and the other bad risks which still pay an annual premium of about two per cent, under which they should agree to pay him this premium for thirty years, and he should promise, in return, to make at his own expense all improvements in construction and equipment which he thought advisable for checking the spread of fire in their buildings, requiring of them only reasonable promptness in using them, and should agree further that at the end of the thirty years any surplus remaining over the actual cost of making good the fire losses during that time should be equally divided between himself and his policy holders. That such a proposition, from a responsible company or individual, would be eagerly accepted by thousands of property owners seems to us hardly doubtful, yet a moment's reflection will show that the labors of the present factory mutual companies have rendered it possible to make such a transaction enormously profitable to the insurers as well as to the policy holders Taking the cost of providing automatic sprinklers, wire-lathing and plastering ceilings, removing wooden cornices and furrings, with the lesser changes required by the mutual rules, at ten per cent on the value of the buildings and contents, the insurer would have to lay out immediately ten million dollars, which, with simple interest at six per cent, would amount in thirty years to twenty-eight millions. The outlay for reimbursement of fire losses at the mill mutual rate for the last year, would be forty thousand dollars a year, amounting with interest at the end of thirty years to two million two hundred and eighty thousand, making a total outlay of thirty million two hundred and eighty thousand dollars, exclusive of the insurer's expenses. The premiums during the same period would amount with interest to one hundred and four million dollars, leaving a net surplus over the outlay of seventy-three million two hundred thousand, half of which, or thirty-six million six hundred thousand dollars, being more than one-third the value of their mills and their contents, would be handed back to the policy-holders, while an equal sum, representing a profit of more than a million dollars a year after allowing six per cent interest on the capital invested in the business, would belong to the insurer. At compound interest the gain would be larger by many millions, and yet the policy-holders would in the end have paid only one-half the regular rates for their insurance, and would have had the salable value of their property increased from the very beginning without cost to themselves, by at least the value of the improvements made upon it. The cost of inspection, salaries of officers, rent, taxes and so on for carrying on an insurance business of this magnitude could easily be estimated from that of present associated factory mutual companies, which insured last year four hundred and six million dollars worth of property, at a total expense for everything except payment of losses, of two hundred and fifty-seven thousand dollars. At the same rate, the cost of the business of insuring and inspecting one hundred million dollars worth of property would be about sixty thousand dollars a year, or for thirty years, including interest, three million four hundred and twenty thousand dollars, leaving a balance of thirty-three million one hundred and eighty thousand dollars as pure profit, the only investment of capital necessary, that of the ten millions needed for improving the construction of the buildings at the outset, being separately repaid with interest, while all current expenses and payment for losses, would be provided for out of the income from premiums.

ONE of the most interesting fires which we find described in the above-mentioned reports occurred at Plymouth, Mass., in a cordage factory. One of the buildings belonging to the factory was used as a picker-room, and stood between two larger buildings, distant about forty feet from each, but communicating with one by means of a closed wooden bridge. One of the larger mills was fitted with automatic sprinklers, and sprinklers of the same sort were being put in the picker building, in place of the perforated pipe sprinklers which had previously protected it. The perforated pipes had been removed, and the new supply-pipes for the automatic sprinklers put in their place, but the men had left the work on Saturday afternoon without screwing on the sprinkler-heads, intending to return Monday morning and put them in place. The picker room was thus left for the moment unprotected, and, to make matters worse, several barrels of oil had been brought into the room to keep them from being chilled. About four o'clock Saturday afternoon, the very common accident of some hard substance striking fire in the picker occurred. The stock in the picker, consisting of manilla, softened with a little oil, took fire, and the flames quickly spread to all parts of the room. A large cast-iron steam-pipe passed through one corner of the picker-room, and while the fire was raging this pipe broke, allowing great volumes of steam to escape into the room. After struggling awhile with the fire in this room, the manager sent men to the mill which was connected by the bridge with the picker-room, to see if there was appearance of danger there. Although this mill was protected by sensitive automatic sprinklers, the men returned, saying that it was on fire "all through and all over," and, together with the picker building, it was totally destroyed. The remaining mill was fitted with perforated pipes, and by turning water on the building was saved.

THE explanation of the sudden outburst of fire in the Number Three mill should, according to the report, be sought in the phenomena attending the combustion of oil or oily matter in a closed room. Under such circumstances an immense amount of gas is generated, which will burst into flame of oxygen is supplied, but in the absence of sufficient oxygen idiffuses itself unchanged. The breaking of the steam-pipe while the oily manilla, and perhaps the oil in the barrels, was

burning, admitted steam enough under pressure to drive the combustible, but unconsumed gases from the oil out of the room by the most available path. The bridge to the Number Three mill afforded the easiest means of escape, and the smoke and gas poured through it, meeting, when it reached the large rooms of the mill, with a fresh supply of oxygen sufficient to cause it to burst into a flame so fierce and sudden that the sprinklers could do nothing against it. In another fire, in Fall River, where a mill provided only with perforated pipes took fire, it is worth noting that the city fire-engines, on arriving at the scene, were utilized with excellent effect, not in throwing a large stream of water taken from the city pipes close by, and thus depriving of their supply the sprinkler-pipes, which were being efficiently managed by the mill officers, but in drawing water from a pond near by and forcing it into the sprinkler feed pipes, which had been provided with a connection, like that of a stand-pipe, for this express purpose. To the prudence thus displayed by the city fire-engineers and the mill officers is to be attributed the saving of the mill, a huge five-story building, which, although marks of fire were subsequently found in the second, third and fourth stories, was not very seriously damaged.

BEFORE the discussion upon the rights and wrongs of labor, which is now progressing so actively, dies away, we should like to call attention to the remarkable speech of M. Alphand, the Director of Public Works in Paris, delivered before the association of mechanics and builders on the occasion of the annual banquet and distribution of medals to the oldest and most faithful workmen in the various trades in the city. M. Alphand, who is a very energetic and able man, has made himself rather conspicuous lately by his successful opposition to the communistic propositions for the enforced reduction of the hours of labor, and the increase of wages, in the Municipal Council, and his address, pronounced at the dinner, over which he presided, seems to have been intended as a defence of his course. That it was a convincing one is shown by the enthusiastic applause with which it was received, and his arguments were so excellent, and so well presented, that we are sorry not to be able to give them in full.

BEGINNING by reminding his audience of the fifty years during which he had been engaged in building-operations, M. Alphand claimed that his long and friendly relations with workmen in the building trades, not only in his civil capacity, but as the commander of a legion entirely composed of architects, builders and workmen, which served in the war of 1870, entitled him to speak for them and to them truthfully, and to show them where, in his opinion, they were deceived by their self-constituted leaders, and in what way they could, if they wished, advance toward the amelioration of their lot. Believing, as he did, that it was the duty of the experienced and well-to-do to protect the interests of his more dependent fellows, he considered it a matter of the first necessity to combat, by all means, the four great errors contained in what were put forward as the claims of the working-classes. The first of these errors, and the most serious, in his opinion, was involved in the idea of uniformity of wages. A uniform scale of wages meant simply the reduction of the income of the good workmen to that of the bad ones; the result of which would be, that the good workmen, finding that their industry and skill were useless to them, would relax their efforts, production would diminish, and the world would grow poor. The second error was that of desiring the limitation of working-hours. For women and children, and in certain industries, such a limitation was necessary to preserve the health of the workers from being sacrificed to their ambition, but a restriction placed on labor with any other object he believed to be a burden, to which Frenchmen would not long submit. In proof of this he said that, since 1848, two laws of the kind had been passed, neither of which had been enforced; and he predicted that no such law, not in the interest of health, could ever be enforced in France, until the character and customs of the country were wholly changed, and the love of liberty inborn in the French race had been destroyed. The third error — that of imagining that the arbitrary raising of wages would be an advantage to the workmen — M. Alphand dealt with very cleverly. If, said he, Paris were a walled town, without commerce, there would be no harm in raising by law the rate of wages. The result would simply be that the prices of everything consumed by the workman would rise in exactly the same degree, so that he could buy, with his large income, just what he did before with his small one, and nobody would be any better or any worse off than before. Unfortunately, however, Paris was not a walled town, but a great manufacturing centre, competing desperately in the markets of the world to sell its goods and keep its inhabitants employed; and the result of a local increase of wages would be to raise the cost of all goods manufactured in the city, preventing them from competing with those of other cities and destroying their market, and with it, the manufactures on which the citizens depended for their living. The fourth error — that of imagining that the working-man would find advantage in driving off the elements of design and supervision by which his work was guided, as well as the capital by which he was maintained until his work was completed, and the product of it sold at a profit — needed no special explanation, and M. Alphand concluded by calling upon his audience of architects, builders and contractors, to interest themselves in the real improvement of the condition of the poor, the road to which must, for the present, he believed, lie through the lessening of the cost of living, the formation of benevolent societies, and the provision of pensions or annuities for the old and helpless.

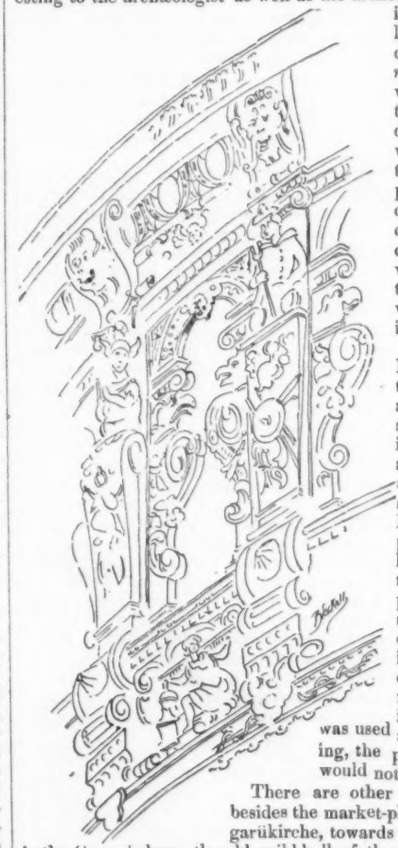
MR. GEORGE KELLER, of Hartford, writes to call our attention to an oversight which was made in one of our accounts of the designing of the wings of the Capitol at Washington, in neglecting to call attention to the connection with the work of Mr. Charles F. Anderson, a New York architect, whose plans received one of the four equal premiums awarded as the result of the competition of 1850 for the extension of the building. No one of the four plans was, however, entirely satisfactory, and the Committee on Public Buildings employed an architect of their own, Mr. Mills, to make a new plan, combining the advantages of all the others. The Mills plan is apparently lost, but the description given in the report of the committee indicated that it corresponded pretty closely with Mr. Anderson's design. While this was going on, President Fillmore, in pursuance of authority given him by another act of Congress, had what seems to be still a different design made, resembling Mr. Anderson's slightly in elevation, but differing entirely from it in arrangement. The act authorized the President to have the plan approved by him carried into execution, under the direction of such architect as he might appoint, and something seems to have been done on the ground when a resolution of the Senate was passed, Calling upon the President to "communicate to the Senate any plan which may have been adopted for the extension of the Capitol," and demanding also information as to the method in which the principles of heating, lighting, ventilation and acoustics were complied with in the design. A year later, the supervision of the work was transferred to the War Department, and Captain (now General) Meigs was appointed to the post which he filled with such signal efficiency. In conference with Professors Bache and Henry, Captain Meigs drew up a modified scheme for lighting, heating and acoustics, and Dr. Walter, formerly the official architect of the Capitol, was skilful enough to conform his design with perfect success to the dispositions desired by his scientific coadjutors. How far the executed plan, which was naturally made after a thorough study of those already in existence, resembled that of Mr. Anderson, we cannot say, and, indeed, Mr. Anderson's must have been a very beautiful design, if it was in any way the prototype of Mr. Walters's, but it was sufficiently like it to make Mr. Anderson think that some of the ideas in it belonged to him, and that he ought to be paid for the use of them. Unfortunately for himself, he imagined that, when the United States got the benefit of any one's property or labor, it paid the owner for them as soon as the propriety of his claim was proved, and it was, apparently, not for some time that he discovered that our system of Government recognizes no obligation, on the part of the public authority, to pay any of its debts, and that the only way for a creditor of the nation to collect his just dues is to draw up a petition, and present it with all the other petitions, honest and dishonest, which come before every Congress, and finally, to devote his life to begging, and whining, and boring his particular petition through Congress and committees to some sort of final action. After once entering, however, the lists of supplicants for Congressional favor, it is not easy to retreat, and Mr. Anderson spent weary years in pleading, and representing, and urging his claim before it was finally reported favorably in the Senate, and a vote passed, appropriating twenty thousand dollars as compensation for his labors.

HANSEATIC ARCHITECTURE.[1] — II.

Of the Hanseatic cities properly so called, Bremen is by all odds the most richly endowed with monuments, Hamburg, as already stated, having lost nearly everything of architectural interest erected subsequently to the fifteenth century. Bremen appears to have been an intermittent adherent to the original League, having been expelled more than once for refusing to submit to the common laws; and when the final union of Bremen, Hamburg and Lubeck arose as a consequence of the dissolution of the confederation, Bremen secured a larger share of freedom and greater privileges than the other cities; at least, she certainly seems to be the more independent now. The Bremen merchants have always been wealthy and prosperous, and, naturally, the best examples of the Hanseatic style are found here. The architectural interest of the city is grouped about the market-place, in the centre of which is one of those great, rudely-carved stone giants, clad in full armor with a long sword in his hand and a weakly benign smile on his face: a figure such as is found in nearly all the Hanse towns, and, under the name of the Roland, is supposed to typify the popular liberty and the independence of the municipality. At one side of the square is the old cathedral, a brick and stone structure which was doubtless quite meaningless in original design, but fortunately one of the two towers of the façade tumbled down long ago as far as the spring of the gable, and the wealthy burghers never cared enough about religious affairs to make good the damage, so now the crumbling old mass of grayish masonry forms a rather interesting group — picturesque, certainly, if not altogether architectural. Two of the other sides of the Place are closely built up with business premises, mostly of a nondescript, stucco character, but among which are a few very noticeable examples of the style under consideration. One of these is illustrated on the sheet of sketches No. 1,[2] and two others are shown in part herewith. They are built of brick and stone, with a great many windows, a minimum of wall-surface and a maximum of ornamentation, especially about the gables which are very high and steep, while the edges are so over-loaded with horns, irregular volutes and aggressive pinnacles that the effect, though striking and interesting at first sight, is not altogether pleasing after a little sober analysis. But the buildings are not lacking in good points, nevertheless. The relation between vertical and horizontal lines is very carefully observed, and the expedient of running all courses across the entire façade without any breaks serves in a great measure to counteract the galvanic effect of the pinnacled gables. In the building shown on the sheet of sketches the intermediate supports of the third story are of wood and quite narrow at that, the outside piers only being of brick, so that nearly the whole width of the façade is taken up by the broad windows, an arrangement which generally gives a very staring appearance to a design, though such is not apparent in either of the three buildings here considered. The lower portions of each of these examples have been so changed from what may be conjectured was their original condition, that it was not considered worth while to sketch more than the upper stories.

The fourth side of the market-place is occupied by the Rathhaus. As this is, all things considered, the finest example of the style, besides being in almost perfect preservation, it may be worth while to examine it in detail. Originally, it was a Gothic structure with plain façade broken by wide, pointed windows, some of which still exist, and are shown by the sketch on the first sheet. Perhaps, also, the broad, hipped roof which now adds so much to the ensemble was an inheritance from the earlier structure, as such an arrangement is seldom met with in the Hanseatic cities, the favorite device being the high, pitched gable at each end of the building. As nearly as can be ascertained, the Rathhaus was erected in the beginning of the fifteenth century, and two hundred years later the façade was remodelled to its present condition, the change including probably the whole of the central bay and the dormers as well as the entire lower arcade; indeed, on the front, as it now stands, there are no traces whatever of the original Gothic design except the canopies and the statues between the windows of the main story, all of which are of quite early origin. It is, of course, impossible in a sketch no larger than the one given herewith to more than slightly indicate the richness of the ornamentation so lavishly spread over the façade. The spandrels of the arcade are filled with armorial bearings supported by gracefully designed figures; the frieze above has in each panel an elaborate scroll of leaf-work with dolphins and sea-horses or little cherubs playing hide-and-seek about architectural forms; while the balustrade is one maze of open-work elaboration. Nor does the ornamentation stop with the arcade. On every column, on the brackets of the cornice, along the narrow frieze of the bay, and clear up to the graceful figure crowning the central gable, carvings are applied without stint. And the work is generally of a quality which will bear a pretty critical examination. It is executed with a great deal of spirit; it is in the main quite delicate in feeling, and is throughout far in advance of anything else produced in the north of Europe during the Renaissance period. There is a color and sparkle to the design which makes it very interesting, no matter how little one may feel in sympathy with the style, and there are bits of composition about the façade which are quite up to the Francis I work of the valley of the Loire, as, for instance, the dormer-windows at either side, and the way in which the central bay is carried up to a graceful termination. Nor does the façade seem overloaded, as might be implied by the foregoing description. The masses are simple throughout, and somehow the long row of arches, the fanciful carvings, the sharply-marked columns about the centre, the quaint old Gothic figures looking down from their pedestals between the windows, and the broad, simple roof, all seem to work together into a consistent whole where the richness of parts is not obtrusive and only comes to one as an agreeable surprise after the mind has taken in the pleasing proportions and the coherent unity of the whole.

The interior of the Rathhaus is only less interesting than the exterior. The whole upper story is one vast hall, nearly one hundred and eighty feet long and forty-five feet wide, with high wood panelling, a curious stone fireplace, a few dingy portraits and other objects of municipal pride. Suspended from the rich wooden ceiling are models of several foreign ships, trophies of Bremen's commercial triumphs, among which is one clumsy brig, with high prow and poop, bearing the American flag. The Gothic windows at either end of the hall are filled with rich stained-glass windows inscribed with the legends and coats-of-arms of the old Hanseatic burgomasters, interesting to the archæologist as well as the artist. A winding staircase in richly-carved oak leads to an upper balcony, the *Güldenkammer*, corresponding with the central bay of the façade, where the dames of the Free City were wont to assemble to witness the grand pageants of the olden days. The rough sketch of a detail of the staircase given herewith will serve to illustrate the style of interior work which was most in favor at this period.



The cellars of the Rathhaus are celebrated for the wines which are stored in them, some of the casks dating back two hundred and thirty years. One of the apartments is richly decorated with Munich frescos and has painted on the vault a huge rose, emblem of the *sub rosa* secrecy imposed on the old counsellors who held their deliberations beneath it; though whether the expression came as a result of the discretion implied, or the symbol was used as the result of the saying, the pompous old custodian would not deign to say.

There are other attractions in Bremen besides the market-place. Opposite the Ausgarükirche, towards the westend of the city is the Gewerbehaus, the old guild-hall of the drapers, erected about 1619, with a façade of stone inferior in design to either of the examples previously noted, but interesting as a bit of time-stained quaintness — a well-proportioned entrance and some effective details, but with a gable run wild with extravagant horns and pinnacles. There are also a few interesting old private houses down by the river side. But beyond these Bremen has little antiquity to offer. The city has grown modern and has its park promenades, its boulevards, its fashionable hotels patronized by Americans and the nobility; and it is withal so clean and tidy, and so full of comfortable, well-built houses of recent date that one cannot feel altogether sorry the old Hanseatic work has gone. Perhaps were there more of the quaint gables and

[1] Continued from No. 532, page 116.
[2] See *American Architect* for March 6.

eccentric carvings, what there is would not be valued as truly for itself.

But if Bremen has changed its appearance and become a model city, the same cannot be said of Lubeck. Indeed, the capital of the Hanseatic League, so far as we can judge, has not materially changed its appearance since the days when its haughty citizens, single-handed, declared war against the king of Denmark, and equipped an army to make good their defence. Those were proud days for the old Free City; and, with the wealth accruing from their far-reaching commercial relations, the burghers were able to spend almost any amounts in architectural efforts. But they must have been a close-fisted race, with all their prosperity, for the monuments which have come down to us — and it is doubtful if any of importance have disappeared — are of far less artistic merit than those of Bremen. Perhaps the Lubeckers were too religious, and loved the house of God more than they did a cosey fireside or a sumptuous town-hall. At any rate, the churches represent the greatest expenditure of money, and, being among the best-existing examples of North-German brickwork, they show that the people were more in earnest, or had better ideas in such directions of architecture, than some of their neighbors; though, as the religious structures, without exception, antedate the Reformation, none of them are in the style at present under consideration. In nearly all of the churches, however, can be found a little Hanseatic work of some form or other. In the Marienkirche there is a very handsome spiral staircase leading to an upper gallery of the choir, erected somewhere about 1670, judging from the appearance of the work, which is all in richly-carved oak, with a few traces of color-decoration. The stairway is preceded by a doorway designed with considerable taste, a drawing of which is given on the second sheet of sketches. In the cathedral, also, there is an elaborate clock in the late Renaissance, set with rich carvings and with a curious dial in the shape of a big, round face, which rolls its eyes ominously with every swing of the pendulum, to the dismay of the small boys. The Rathhaus, the ancient seat of the Hanseatic Diets, is still in good trim — a stately structure of brick, dating principally from 1440, but with a handsome staircase of 1570, picturesquely-arranged on the outer street front, the most interesting portion of which is shown on the sheet of sketches. The upper-work is entirely of wood, the columns and arches only being of stone. Much of the ornamentation has been eaten away by time, and the whole has suffered a great deal, but enough remains to illustrate the idea. Farther along, on the same side of the Rathhaus, is the bay-window, shown with the sketches, also of wood, and sadly dilapidated.

Lubeck has quite a number of smaller buildings of the later Hanseatic period, one of the best of which is the house of the *Kaufleute Compagnie*, dating from 1585, containing council and audience rooms panelled and wainscotted in dark-toned old oak, with heavy-timbered ceilings, and rich carvings and elaborate inlays, used in a way which shows that the Lubeckers knew how to spend their money when the fancy seized them to have something really good. And in a more moderate line, there are long streets full of interesting houses dating from the sixteenth and seventeenth centuries, with high, quaintly-disposed gables, abounding in odd volutes and exclamatory obelisks and grotesque figures looking down from a niche somewhere and displaying the family-arms; roccoco pediments and attenuated columns about the windows, of a kind which would seem thoroughly bad anywhere else, but which in place have a quaint charm which is often vainly sought after in more seriously-studied work; high door-posts, covered with just such strap-work as that which the Elizabethan architects applied indiscriminately to ceiling or stair-newel, and which, in our days, sometimes becomes degenerated into an adjunct of the jig-saw style; and occasionally a broad-arched entrance-way, such as that shown on the sheet of sketches, simple in spite of the meaningless stucco-figures piled above it, and full of the sparkle and life which a judicious use of effective mouldings can give to an arch. Down by the river Trave, also, there is an interesting old wine-tavern with an elaborately-designed tap-room, in good order yet, after two centuries and a half of wear. Lubeck is chiefly interesting to the architect for its brickwork of an earlier period, but there are a great many bits of good Renaissance work scattered through the city, which will repay the task of hunting them out, and which cannot be disregarded in a consideration of the architecture of the Hanseatic League.

There are numerous examples of the style in other cities of Northwestern Germany. Brunswick was one of the firmest adherents to the League, and has several interesting structures of the sixteenth century, notably the *Gewandhaus*, near the market, a building in brick and stone, carried out over the street, rising from three stumpy columns and a series of depressed arches, and ending in a tall gable, devoid of the aggressive horns and pinnacles of the Hamburg buildings, but designed more quietly and in better taste. And Hanover has a number of examples, the best of which is the Leibnitz House, really quite good in its way, and in some details equal to the central bay of the Bremen town-hall. But, outside of the older Hanse towns, the style becomes plainly an exotic, for in nearly every instance the example will be surrounded by other houses bearing the same or a later date, though designed in an entirely different style and spirit. Berlin, itself once a member of the League, has but a single reminder of the Hanseatic influence — a little corner of the old royal palace which overlooks the Spree, the only bit of picturesque architecture in all the stiff modern city.

There are a few general features of the style which naturally suggest themselves to any one making even the most superficial study thereof. One noticeable point is the entire absence of chimneys as features of the general design, a marked contrast to the manner in which the English and French architects of the same period so gracefully utilized these most important factors of a modern house. Nowhere in any of the Hanse towns does the chimney make its appearance as an ornamental feature, and even in the Bremen town-hall, which contains a large fire place, the chimney is led up at the rear and concealed behind the big roof. Again, it is interesting to note how stone is considered essential to every design, brick being merely a filling. Doubtless the Hanse architects knew better than to attempt the fine detail characteristic of the style in so clumsy a medium as brick, and hence, when it was impossible to obtain the better material, they used stucco, as was sometimes the case at Lubeck, though the rareness of such usage shows a decided reluctance to employ so cheap a substitute. The round arch is not often met with in the old work. The depressed arch, accommodating itself to different spans with the same rise, was the favorite form, and was generally used without mouldings of any sort — a flush arch in brick, with stone-springing and key-blocks. In the carved ornamentation which was so lavishly applied, the human figure plays a prominent part, but rarely on a large scale, always as an accessory to a panel, or as a terminal piece, too small to count as anything more than a finial that is to say, isolated statues were seldom used, the figures on the Bremen Rathhaus belonging to an earlier period, as previously stated. In one respect the buildings of this period never failed: they were always picturesque, and were pleasing to the eye in summer or winter, depending on themselves for charms of this kind, and being quite independent of accidental conditions of season or surroundings. They were harmonious in tone too, nearly always avoiding the staring, obtrusive qualities, which somehow, seem almost inseparable from modern combinations of bright-red brick and light-colored sandstone. And the designs, as a rule, finished well; the gables were satisfactory, not in their details, perhaps, nor in the fantastic outlines in which the old builders delighted to indulge their fancy, but in the general manner the design was built up from the broad wall-space or the crowded range of windows below, to the easily-managed finial pinnacle. There is no indecision about the idea, however fussy some fragments of the execution may appear; and, while no one would claim for the Hanseatic architecture any more than it is worth, or put it on an equality with what the same period produced in France, it was an honest attempt, and cannot be despised, especially in this busy period of the nineteenth century, when the tendency of architecture is to be omniverous in selection, striving to draw the good from all styles. The architectural attempt has got to be pretty bad which has not some good points about it, and, in any case, we who are called on to use brick and stone so extensively can surely draw some suggestions of practical value from the old Hanse architecture.

C. H. Blackall.

THE PRINCIPLES OF DOMESTIC FIREPLACE CONSTRUCTION.

Bay Window in Cloister. St Cross. Winchester. Engd

THIS was the subject of the Friday evening discourse at the Royal Institution on February 5th, the lecturer being Mr. T. Pridgin Teale, M.A., F.R.C.S., who is already known to most of our readers as an investigator in this important field of applied science, and as a writer on sanitary subjects.

Mr. T. Pridgin Teale, at the outset referred to the appropriateness of the use of the lecture-theatre of the Royal Institution for a lecture on this subject, seeing that Count Rumford, the founder of the Institution, devoted a great deal of attention to the study of the subject, which was particularly referred to in the prospectus of the Institution as "a very important part of the useful information to be conveyed in the public lectures of the Royal Institution." Correct principles, said the lecturer, have been habitually, and, until the last few years, almost universally, violated, and the rules so ably worked out, so earnestly and forcibly advocated by Rumford, have lain dormant, lingering here and there, chiefly in old-fashioned houses, and almost forgotten. Three evils result from the prevalence of bad principles in construction: 1. Waste of fuel and

loss of heat. 2. Excessive production of soot and smoke. 3. Large addition to ash-pit refuse by cinders, which are really unburned, and therefore wasted, fuel. These are matters of national concern, and it has been the main object of my labors on this question during the last four years to endeavor to convince the public that it is the interest no less than the duty of every householder, to burn his fuel on correct principles, and to do his part towards the diminution of these evils. Heat is wasted in three ways — either by combustion under the impulse of strong draught, which means rapid escape of heat up the chimney; or by imperfect combustion of the gases which are generated during the burning of the coals; or by escape of heat through the iron sides and back into the space between the range and the brickwork and its top into the chimney. The greatest offenders are the ordinary register grates. Iron all over, back, and sides, and roof, they are usually set in a chamber open above to the chimney, and imperfectly filled in, or not filled in at all, with brickwork. The heat escapes through the iron to this chamber, and thence is lost. Another fault is that the "register opening," in other words the "throat of the chimney," being immediately above the coal, submits the burning fuel to the full concentrated force of the current to the chimney, converting the fire into a miniature blast-furnace.

The second result of faulty construction in fireplaces is "undue production of smoke and soot." Smoke and soot imply imperfect combustion, and to this two defects in a fire mainly contribute — one, too rapid a draught through the fire which hurries away and chills below burning point the gas rising from the heated fuel. The other defect is too cold a fire, *i.e.*, too small a body of heat in and around the fuel, so that the temperature of the gases is not raised to a point at which they will burn.

A few years ago the prevalence of unusually dense fogs roused the metropolitan public to a sense of this great evil. The Smoke Abatement Society was formed, and under its auspices exhibitions of smoke-consuming apparatus and improved fireplaces were held in London and Manchester. Beyond the fact that certain grates were pronounced to be good in point of economy, and moderate in the production of smoke, and that the public has been led to take an interest in and inquire into the relative value and economy of various patent fireplaces, there has been but little advance in the education of the public in the principles which lie at the root of the whole question.

A third result of bad construction is the "production of cinders." With good coal, cinders are inexcusable. They are unconsumed carbon — coke — and imply a faulty fireplace. If thrown into the ash-pit, as is the case in ninety-nine times out of one hundred, they are shameful waste, and more than waste, for they entail a great cost for their removal. The town of Leeds pays about £14,000 a year for the scavenging of the streets and the emptying of ash-pits. Nearly every house in Leeds supplies, in the way of cinders, at least twice as much ash-pit refuse as it might do were the fireplaces properly constructed. The ash-pit refuse of Leeds is burned in a "destructor," and the cinders in the refuse provide not only heat enough for its reduction to a mineral residue, but spare heat for driving two sixty-horse-power engines, and for consuming a reasonable amount of pigs, etc., killed by, or on account of disease.

These three great evils, evils affecting not only individuals, but the community, waste of fuel and heat, production of soot, production of cinders, are a direct result of the violation of the correct principles in fireplace construction.

Let us next inquire what are the principles which promote good combustion in an open fireplace — *i. e.*, what are the conditions which are essential to enable fuel to give out to a room "good money's worth in heat." That such a result may be obtained fuel must burn *well*, but *not rapidly*. Two things in combination are essential to the combustion of fuel — a supply of oxygen and a high temperature — *i. e.*, plenty of heat around the fuel. If fuel be burned with a hot jacket around it, a very moderate amount of oxygen will sustain combustion, and if the supply of oxygen be moderate, combustion is slow. Burn coal with a chilling jacket around it, a rapid conductor like iron, and it needs a fierce draught of oxygen to sustain combustion, which means rapid escape of actual heat, and also of potential heat in unburned gases and smoke, up the chimney. This is the key to the whole position; this is the touchstone by which to test the principles of fireplace construction.

Few people probably realize the exact conditions of combustion, which may be well illustrated from the process of manufacture of coal gas.

In the manufacture of gas, coal is raised to a high temperature, and the gasses are driven off by roasting the coal in an oven from which air, *i. e.*, oxygen is shut out. The gasses are conducted away, cooled, purified, and stored for future use in a gasometer; the combined carbon and mineral residue, being non-volatile, is cooled down before being exposed to the air, and is sold as coke. Here we have a striking proof that high temperature in fuel does not of itself imply combustion. If air were admitted to the red-hot coke, or to the gases as they escape in their heated condition from the furnace, they would burn. But when coke has become cold, and the gases are cold, as in a gasometer, no amount of oxygen will of itself start combustion. The deduction from all this is, that complete oxydation, *i. e.*, good combustion, is possible only when the fuel and gases are at a high temperature, and that high temperature of fuel does not produce combustion until oxygen is introduced; therefore we can have a high temperature of fuel without rapid combustion, provided we control and limit the supply of oxygen. My attention was first directed to the question of waste of fuel at the time of the coal famine some twelve years ago. I read in the *Times*, and acted upon the suggestion made, I believe, by the late Mr. Mechi, to economize coal by inserting an iron plate on the grid under the fuel so as to cut off all draught through the fire. This undoubtedly induced slow combustion, and economized fuel, but the fire was dull, cold and ineffective. The plan was abandoned. It taught me, however, the fact that combustion could be controlled by cutting off the under-draught, but I did not then see why combustion was spoiled. The reason was that the under-surface of the fire was chilled, and the fuel lost its incandescence owing to the rapid loss of heat through the iron towards the open hearth chamber. To some persons even now "slow-combustion stoves" are an abomination, and are supposed to be synonymous with bad combustion. The next stage in my fireplace education was the adoption of the Abbotsford grate. I thereby learned that the reason why an Abbotsford grate was an advance upon the iron plate lay in the fact that the solid fire-brick bottom stored up heat, and enabled the fuel to burn more brightly resting upon a hot surface — not upon a cooling iron plate. But Abbotsford grates, and the other class of grates with solid fire-brick bottoms, the "parson's" grates have disadvantages. They are apt to become dull and untidy towards the end of the day, and do not burn satisfactorily with inferior coal. There is a better thing than a solid fire-brick bottom, and that is the chamber under the fire closed in front by an "economiser." Some five years ago I made, somewhat accidentally, the discovery that the burning of coal in an ordinary fireplace could be controlled and retarded by the adoption of a very simple and inexpensive contrivance, applicable to nearly every existing grate, and that this result could be attained without impairment of, and often with increase of, the heating power of the fire. This contrivance, which I have named an "Economiser," was simply a shield of iron standing on the hearth, and rising as high as the level of the grid at the bottom of the grate, converting the hearth space under the fire into a chamber closed by a movable door. The effect was twofold. The stream of air, which usually rushes through the bottom of the fire, and causes for a short time rapid combustion at a white heat, was thereby cut off, and the air under the fire was kept stagnant, the heated coal being dependent for its combustion on the air passing over the front and the upper surface. The second point was that this boxing up rendered the chamber hotter, and this increased temperature beneath the fire-grate, *i. e.*, under the fuel, added so materially to the temperature of the whole, even of the cinders coming into contact with the iron grid, that the very moderate supply of oxygen reaching the front and upper surface of the fuel was sufficient to maintain every portion in a state of incandescence. Moreover, I observed that combustion was going on at an orange, not at white, heat. Let us contrast a white with the orange heat: A white heat in a fire means rapid combustion, owing to the strong current of air, oxygen, which passes under the grate, through the centre of the fire, and up the chimney. As soon as the heart of the fire has been rapidly burned away at a white heat, the fuel cools; the iron grid cools also; and the cinders in contact with the grid are chilled below combustion point. They then cease to burn, and the bottom of the fire becomes dead and choked. The poker must now be brought into play to clear away the dead cinders, and to re-open the slits in the chocked grid. New coal is added to the feeble remnant of burning embers, with no reserve of heat in the iron surroundings; and in time, and perhaps very slowly, the fire revives, and rapid combustion sets in afresh under the influence of the renewed current of oxygen passing through the heart of the fire. An orange heat means that the coke, *i. e.*, the incandescent cinder, is burning with a slowly applied stream of oxygen, a degree of combustion which is only possible when the coal is kept warm by the hot chamber beneath, and by a reasonable limitation of loss of heat at the back and sides by fire-brick, either in contact with the fuel, or, at least, close behind the iron surrounding it. This effect is seen, partially, in the grates with solid fire-brick bottom, but far more perfectly in the grates with the chamber closed by the "Economiser."

This hot chamber has the following effects: The incandescent coal remains red hot from end to end of the grate until nearly all is consumed, thus maintaining a larger body of the fuel in a state to radiate effective heat into a room. The cinders, on coming into contact with the iron grid remain red hot, and so continue to burn away until they fall through the grid as a fine powder. This allows the fire to burn clearly all day long almost without poking. When the fire is low, and new coal is added, the reserve of heat in the hot chamber is such that the addition of cold fresh fuel does not temporarily quench the embers, and the fire is very quickly in a blaze after being mended.

Having made the discovery by the observation of a grate supplied to me with an "Economiser," the value of which, I suspect, was hardly appreciated by the makers, I applied "Economisers" one by one to all my grates, kitchen included. The result surpassed my expectations. There was a saving of at least a fourth of my coal. The experience of many friends, who at my advice adopted the system, confirmed my own results. It was, therefore, clear to me that I was bound to make widely known a discovery which was fraught with such benefit to myself, and was likely to prove a great boon to the public. My chief aim hitherto has been to persuade the public to apply the "Economiser" to existing fireplaces. After steady exertions for four years, some impression has been made on the iner-

tia of the public, and extensive trials of the "Economiser" are taking place in many parts of the country. To-day, however, my aims are more complete. It is my wish to advocate not one principle alone, although that is the cardinal one, but to urge all the best principles which enter into the construction of a really effective fireplace, and to induce those whom it may concern to replace bad by an entirely new construction, right in every point. The rules of construction which I shall lay down have been arrived at entirely by my own observation of what appeared to be the best point in various fireplaces. It was, therefore, no less a satisfaction to me than a surprise to discover, on reading Rumford's work in preparation for this lecture, that nothing which I have to advocate is new, but that every principle, and the "Economiser" is hardly an exception, was advocated no less enthusiastically by him at the very commencement of this century.

1. "As little iron as possible." The only parts of a fireplace that are necessarily made of iron are the grid on which the coal rests, and the bars in front. The "Economiser," though usually made of iron, from convenience in construction, might be of earthenware, and so would be more perfectly in harmony with this rule.

2. "The back and sides of the fireplace should be of brick, or fire-brick." Brick retains, stores, and accumulates heat, and radiates it back into the room, and keeps the fuel hot. Iron lets heat slip through it up the chimney, gives very little back to the room, and chills the fuel.

3. "The fire-brick back should lean over the fire, not lean away from it," as has been the favorite construction throughout the kingdom. The lean over not only increases the power of absorbing heat from rising flame —otherwise lost up the chimney — but the increased temperature accumulated in the fire-back raises the temperature of gases to combustion point, which would otherwise pass up the chimney unconsumed, and thus be lost. Rumford discovered accidentally the value of this "lean-over," and at once realized its immense importance. He does not, however, seem to have carried out his intention of working out for general adoption this form of back. Of recent years "lean-over" backs have been reinvented and sparingly used. The "Milner" back, invented by a Lincolnshire clergyman, and adopted by Barton & Co., is excellent. It burns fuel well and gives out a great heat. But it is extravagant in consumption unless controlled by the "Economiser." Captain Douglas Galton saw the virtue of the "lean-over," and adopted it in the grate which goes by his name. The "Bee-hive" back was the same in principle and very good, and, having a very small grid, was economical. The "Rifle" back, adopted by Nelson & Sons, of Leeds, gives an admirable fire, little short of perfection; but observation shows that the "tall" flame extends far beyond the bend, and is, therefore, soon lost as a heating factor, the heat being wasted in the chimney.

4. "The bottom of the fire, or grating, should be deep from before backwards, probably not less than nine inches for a small room, nor more than eleven inches for a large room." This is a corrollary to Rule 3. We cannot possibly have the back of the fireplace overhanging the fire when there is a shallow grid. If for no other reason than the demands of the "lean-over," depth of fire space is essential. But there is gain, thereby in another direction. It affords plenty of room for the burning fuel to lie down close to the grid, and away from swift air-currents, and prevents the tendency of the fire to burn hollow.

5. "The sides or 'covings' of the fireplace should be inclined to one another like the sides of an equilateral triangle." The working out of this rule has cost me much thought and experiment. It was worked out more or less empirically with a view to attain certain objects, and, having attained them, I discovered that I had unwittingly selected the sides of an equilateral triangle. It is of some importance, and may be of interest, to tell how the question arose. In my earlier fireplaces the sides or "covings" were parallel to each other, and had the defect that they radiated most of their heat from one to the other, not into the room, with the probable result that much of such heat would eventually escape up the chimney. It was clear then that the sides must be set at an angle with the back, so as to face towards the room. But at what angle? My first experiments were determined by the shape of the corner bricks which were in the market. These determined the inclination of the sides to be such that, if prolonged, they would meet at a right angle. This is the angle laid down by Rumford as the angle of selection, but as the largest angle admissible in a good fireplace. This angle, however, brought me into difficulties with my "lean over" back. The openness of the angle made the back, as it ascended, spread out so rapidly that what was gained in width was lost in height. Moreover, my critics objected to its appearance as ugly. What then should determine the inclination of the sides? The point was thus determined. Seeing that a heated brick throws off the greatest amount of radiant heat at a right angle with its surface, the "covings" should at be such an inclination to each other that the perpendicular line from the inner margin of one "coving" should just miss the outer margin of the opposite "coving." Where the "covings," as in my earlier attempts and in Count Rumford's fireplaces, are at a right angle to each other, this perpendicular line misses the opposite margin by several inches. It was clear, therefore, that the inclination might be made more acute. Guided by this idea, and having determined the principle on which the shape of the grate should depend, an inclination was arrived at which turned out to be an angle of sixty degrees, *i. e.*, the inclination of the sides of an equilateral triangle.

6. "The 'lean over' at the back should be at an angle of seventy degrees." Commencing at the level of the top of the front bars, it should extend almost to the throat of the chimney, which, as a rule, will be about twenty-eight inches from the hearth, or sixteen inches from the top of the fire, and should extend so far forwards that the angle where it recedes towards the chimney should be vertically over the insertion of the cheeks of the fire-grate. This will be from three and one-half to four and one-half inches from the front of the fireplace, according to the size of the grate.

7. "The shape of the grate should be based upon a square described within an equilateral triangle, and the size to vary in constant proportion to the side of the square." For a moderate room, eight inches determines a very useful size; for larger rooms, nine inches, ten inches, or even eleven inches may be necessary. An area of grating of one hundred inches in the square of the corners would give a grate fireplace large enough for a room twenty feet by twenty-five feet. This rule secures sufficient depth from front to back, and a constant proportion between depth and width, whatever be the size of grate. Whenever a grate proves too large for a room, and in summer, when a smaller fire is needed, the size should be reduced in width by firebrick, the fuel depth being retained.

8. "The slits in the grating, or grid, should be narrow, perhaps one-quarter of an inch for a sitting-room grate and good coal, three-eighths of an inch for a kitchen grate and bad coal." When the slits are larger small cinders fall through and are wasted.

9. "The front bars should be vertical, that ashes may not lodge and look untidy; narrow, perhaps one-quarter of an inch in thickness, so as not to obstruct heat; and close together, perhaps one inch apart, so as to prevent coal and cinder from falling on the hearth."

10. "There should be a rim one inch or one and one-half inch in depth round the lower insertion of the vertical bars." The object of this is to conceal the ash at the bottom of the fire, and to enable the front cinders to burn away completely by protecting them from the cold air. The rim contributes greatly to tidiness, and, as a rule, will prevent the need of any sweeping up the hearth during the day.

11. "The chamber under the fire should be closed by a shield or 'Economiser.'" This has been already spoken of, and described as the central principle which enhances greatly the value of all the rest.

12. "Whenever a fireplace is constructed on these principles, it must be borne in mind that a greater body of heat is accumulated about the hearth than in ordinary fireplaces. If there be the least doubt whether wooden beams may possibly run under the hearth-stone, then an ash-pan should be added, with a double bottom, the space between the two plates being filled with artificial asbestos, 'slagwood,' one and one-half inch in thickness."

13. "A fireplace on this construction must not be put in a party-wall where there is no projecting chimney-breast, lest the heated back should endanger woodwork in a room at the other side."

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

"SEA VERGE." THE DINING-ROOM. MONMOUTH BEACH, N. J. MR. BRUCE PRICE, ARCHITECT, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

THIS room in the house of George F. Baker, Esquire, is finished in redwood. The house itself is built of brick with Carlyle stone for finish and Akron tiles for the roof. Oak is used for inside finish in most of the rooms.

OLD COLONIAL WORK, NOS. IV AND V. GATE-POSTS, SALEM, MASS. MEASURED AND DRAWN BY MR. F. E. WALLIS, BOSTON, MASS.

HANSEATIC ARCHITECTURE, II. SKETCHED BY MR. C. H. BLACKALL.

For description, see article elsewhere in this issue.

CHURCH OF THE MESSIAH, BROOKLYN, N. Y. MR. R. H. ROBERTSON, ARCHITECT, NEW YORK, N. Y.

DETAILS OF THE SAME.

ARCHITECTURAL STUDENTS who desire to take part in the third annual examination for the Rotch Travelling Scholarship are requested to present themselves at the Museum of Fine Arts, Boston, at nine o'clock on Saturday, April 3.

DISCOVERIES OF STATUES IN THE ACROPOLIS, ATHENS. — A few days ago, in the course of some excavations at the Acropolis, Athens, near the Erectheum, three statues of women, in an excellent state of preservation, half as large again as life, with large heads, and completely colored, were discovered. They belong to the period before Phidias, are delicately finished, and are of an archaic art, admirably preserved. — *Philadelphia Press.*

No. 556 American Architect and Building News, Apr. 3 1886.

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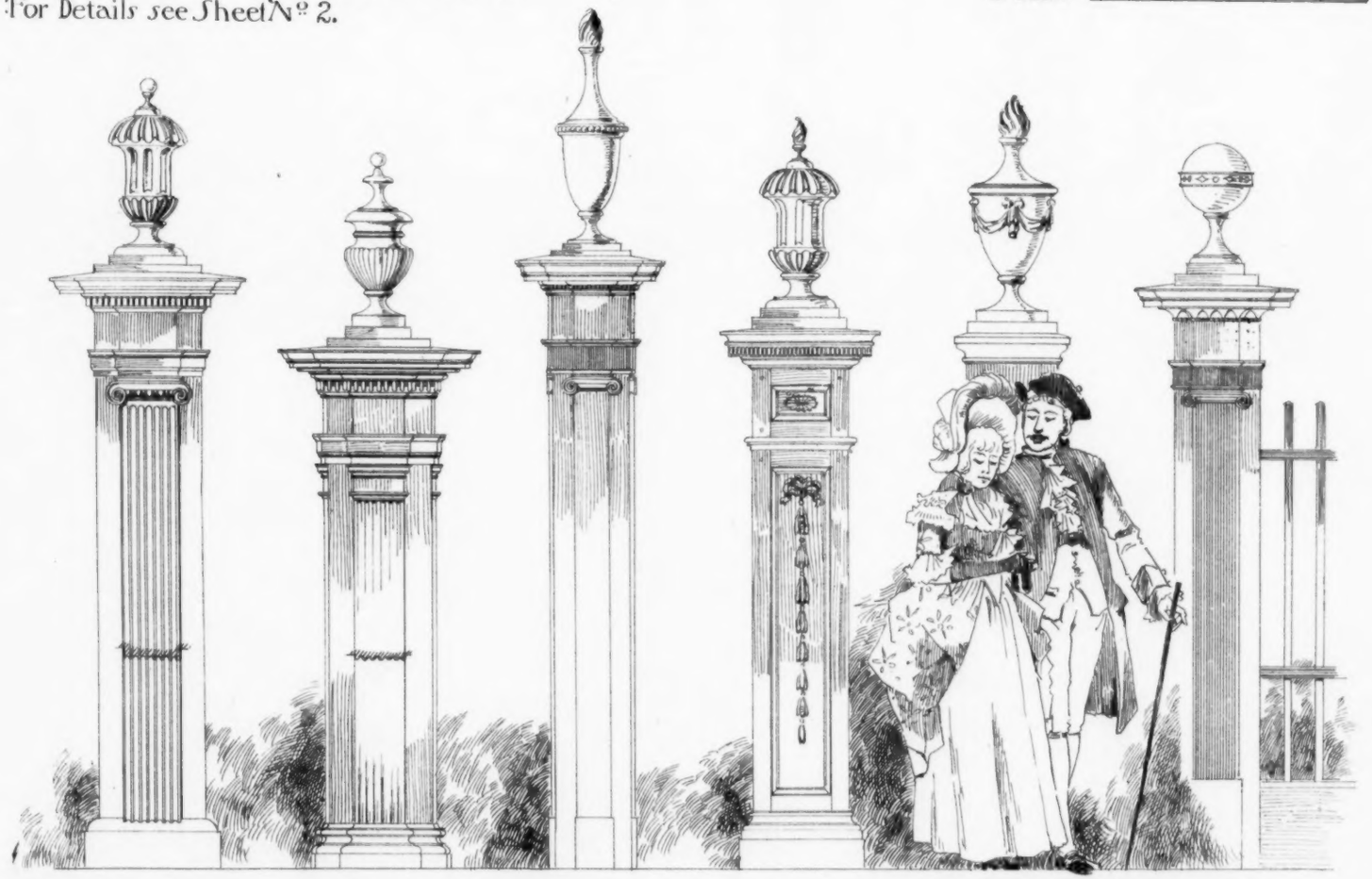
Old Colonial Work, IV.

··Fence·Posts·· Salem··Mass··1·

For Details see Sheet No. 2.

Scale 3 6 9 12 inches. 1 foot 2 feet



25. Chesnut St. 34. Chesnut St. Washington Sq. Federal St. Federal St. Lafayette St.

Supposed to have been designed by Mr. Intire, Archt. early in this Century.

Measured and drawn by Frank E. Wallis.

HELIOTYPE PRINTING CO. BOSTON

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CHURCH OF THE MESSIAH, BROOKLYN, N.Y.
R.H. Robertson, Architect, N.Y.

HELIOTYPE PRINTING CO. BOSTON

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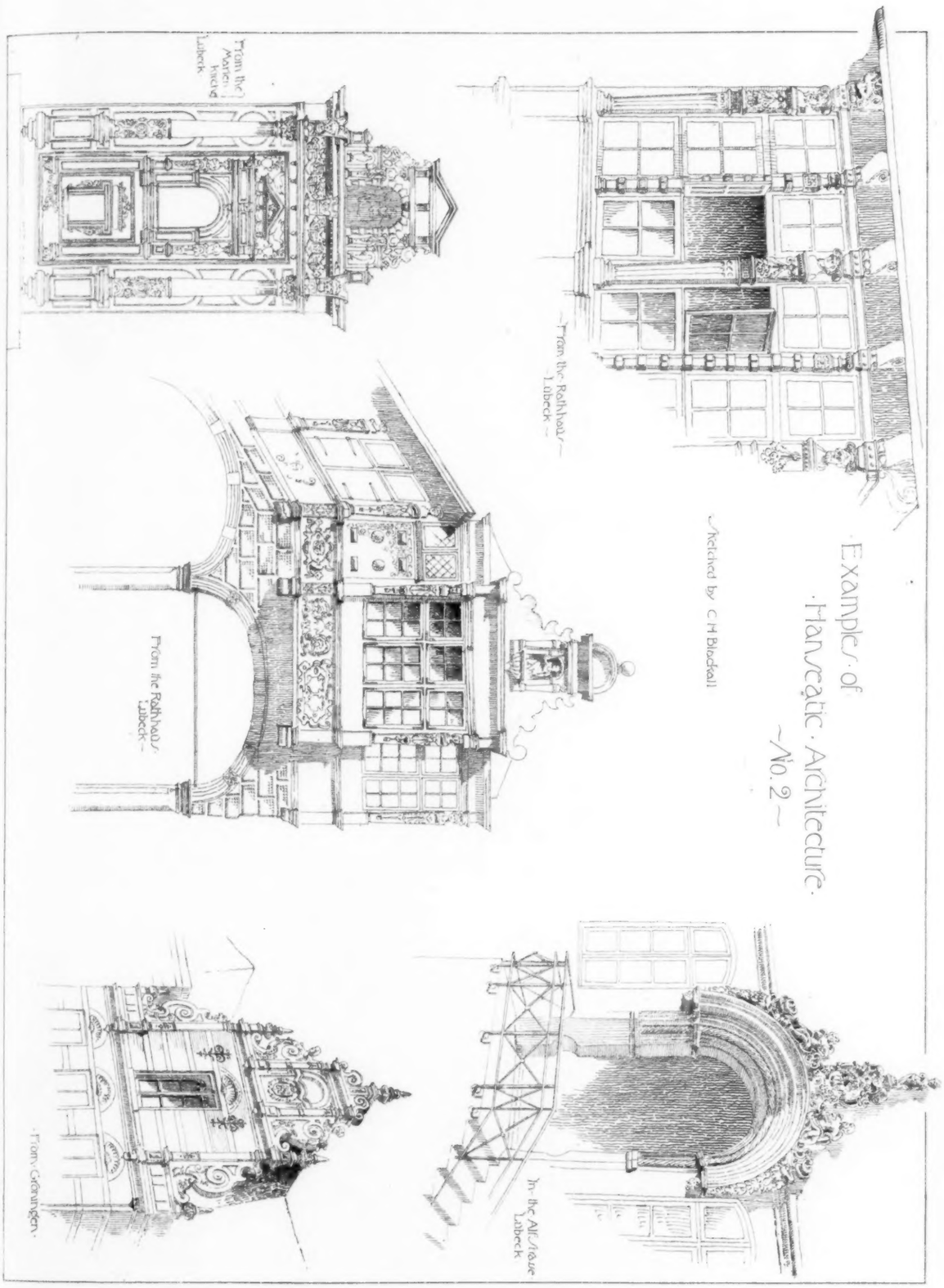
Examples of Hanseatic Architecture. —No. 2—

Sketched by C. H. Blackall



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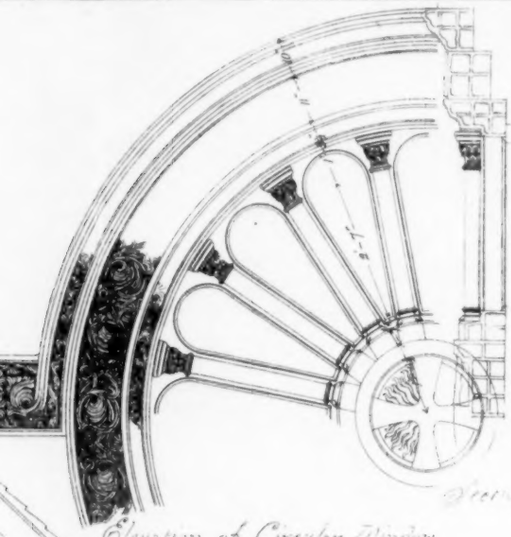
CHURCH OF THE MESSIAH, BROOKLYN, N.Y.

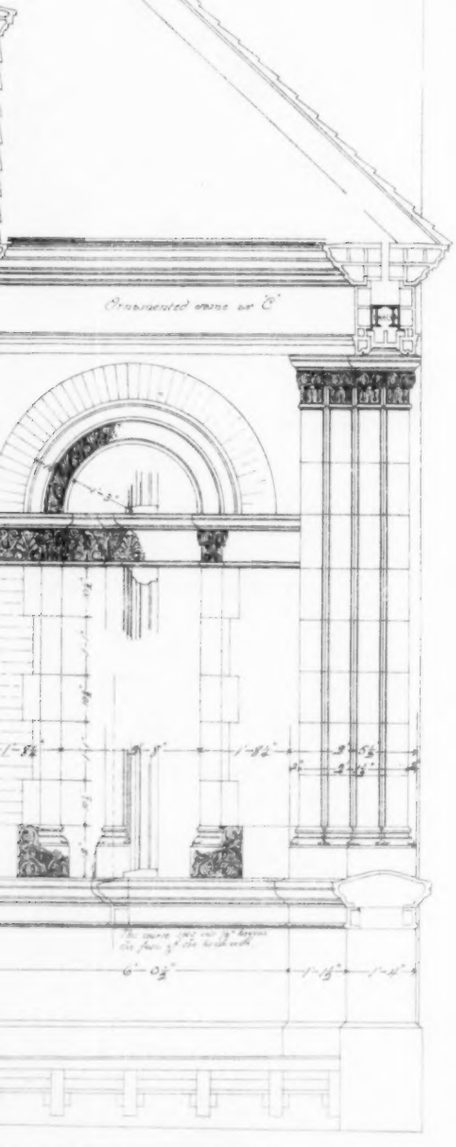
R.H. Robertson, Architect, N.Y.

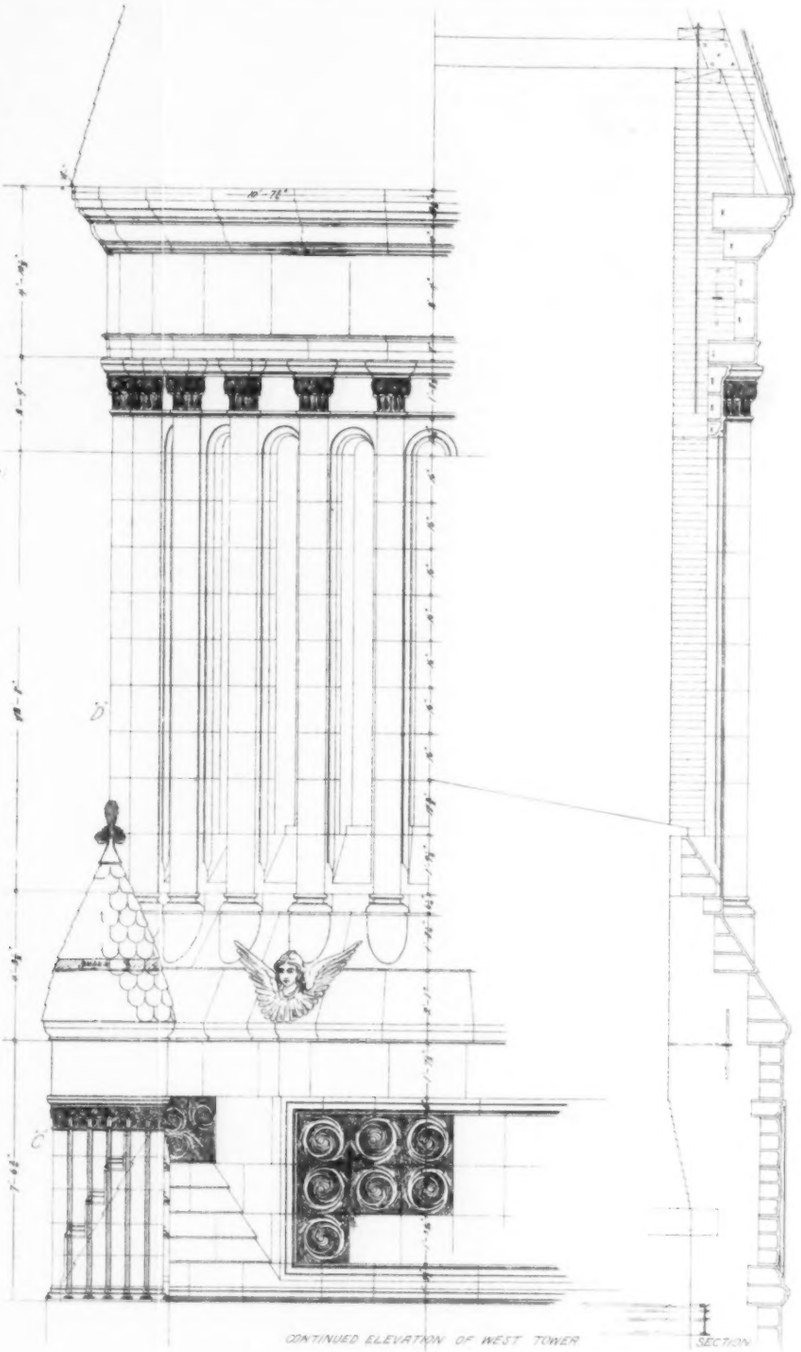
DETAILS:

LIMITED, 1886, TICKNOR & CO.



Elevation of Circular Window in Centre Gable





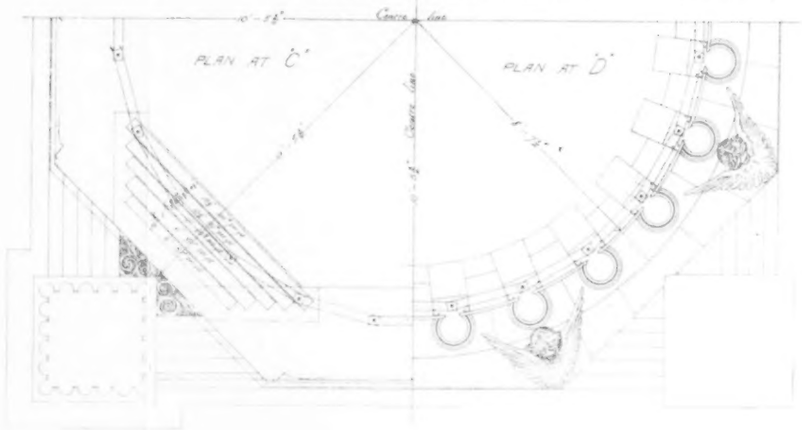


Photo-Relief Printing Co. Boston

American Architect and Building News, Apr. 3 1886. No. 536

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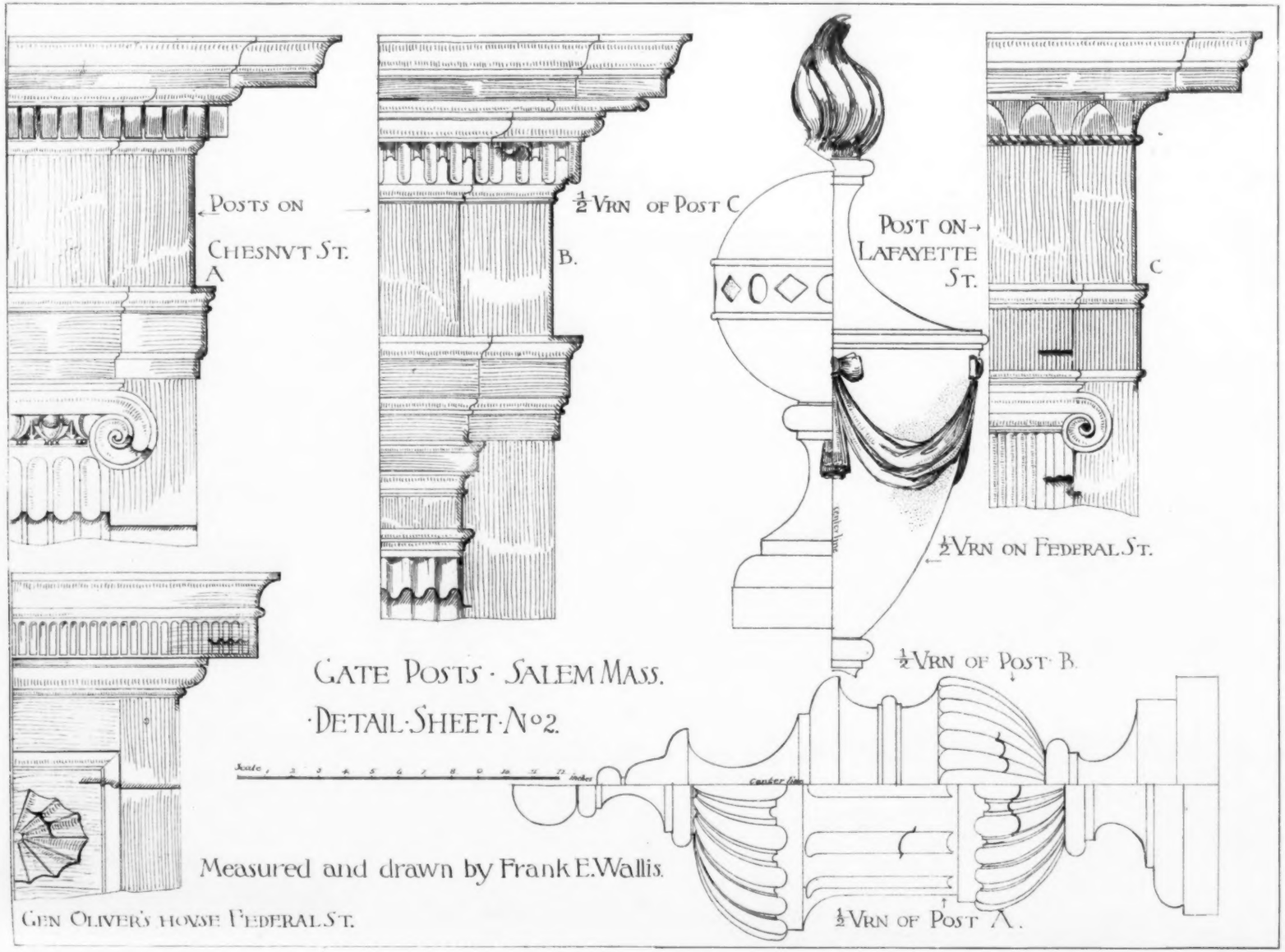

Heliotype Printing Co. Boston.

SAFE BUILDING.[1]—II.

MOMENT OF INERTIA.

(German, *Trägheitsmoment;* French, *Moment d'énertie*, or *Moment de giration.*)

THE moment of inertia, sometimes called the moment of gyration; is the formula representing the inactivity (or state of rest) of any body rotating around any axis. The reason of the connection of this formula with the calculation of strains and the manner of obtaining it cannot be gone into here, as it would be quite beyond the scope of these articles. The moment of inertia of any body or figure is the *sum* of the products of each particle of the body or figure multiplied by the *square* of its distance from the axis around which the body or figure is rotating.

A table of moments of inertia, of various sections, will be given later on and will be all the student will need for practical purposes.

THE CENTRE OF GYRATION AND RADIUS OF GYRATION.

(German, *Trägheitsmittelpunkt;* French *Centre de giration.*)

The centre of gyration "is that point at which, if the whole mass of a body rotating around an axis or point of suspension were collected, a given force applied would produce the same angular velocity as it would if applied at the same point to the body itself." The distance of this centre of gyration from the axis of rotation is called the *radius of gyration* (German, *Trägheitshalbmesser;* French, *Rayon de giration*); this latter is used in the calculation of strains, and is found by dividing the moment of inertia of the body by the area or mass of the body, and extracting the square root of the quotient, or

$$\varrho = \sqrt{\frac{i}{a}}, \text{ or}$$

$$\varrho^2 = \frac{i}{a}.$$

A table will be given, later on, of the "squares of the radius of gyration" (German, *Guadrat des Trägheitshalbmessers;* French, *Carré du rayon de giration*).

THE MOMENT OF RESISTANCE.

(German, *Widerstandsmoment;* French, *Moment de résistance*).

The moment of resistance of *any* fibre of a body, revolving around an axis, is equal to the moment of inertia of the whole body, divided by the distance of said fibre from the (neutral) axis, around which the body is revolving.

A table of moments of resistance will be given later on.

MODULUS OF ELASTICITY.

(German, *Elasticitäts modulus;* French, *Module d'élasticité*).

The modulus of elasticity of a given material is the force required to elongate a piece of the material (whose area of cross-section is equal to one square inch) through space a distance equal to its primary length. Thus, if a bar of iron, twelve inches long, and of one square inch area of cross-section, could be made so elastic as to stretch to twice its length, the force required to stretch it until it were twenty-four inches long would be its modulus of elasticity in weight per square inch.

MODULUS OF RUPTURE.

(German, *Brechungscoefficient;* French, *Module de rupture.*)

It has been found by actual tests that though the different fibres of materials under transverse strains are either in compression or tension, the ultimate resistance of the "extreme fibres" neither entirely agrees with their ultimate resistance to compression or tension. Attempts have been made to account for this in many different ways; but the fact remains. It is usual, therefore, where the cross-section of the material is uniform above and below the neutral axis, to use a constant derived from actual tests of each material, and this constant (which should always be applied to the "extreme fibres," *i. e.*, those along upper or lower edge) is called the modulus of rupture, and is usually expressed in pounds per square inch.

TO FIND THE MOMENT OF INERTIA OF ANY CROSS-SECTION.

Divide the cross-section into simple parts, and find the moment of inertia of each simple part around its own neutral axis (parallel to main neutral axis); then, if we call the moment of inertia of the whole cross-section i, and that of each part $i_{,}$, $i_{,,}$, $i_{,,,}$, $i_{,,,,}$ etc., and, further, if we call the area of each part $a_{,}$, $a_{,,}$, $a_{,,,}$, $a_{,,,,}$ etc., and the distance of the centre of gravity of each part from the centre of gravity of the whole cross-section, $d_{,}$, $d_{,,}$, $d_{,,,}$, $d_{,,,,}$ etc., we have:—

$$i=(d_{,}{}^2a_{,}+i_{,})+(d_{,,}{}^2a_{,,}+i_{,,})+(d_{,,,}{}^2a_{,,,}+i_{,,,})+(d_{,,,,}{}^2a_{,,,,}+i_{,,,,})+, \text{ etc.}$$

[1] Continued from page 112, No. 532.
[2] See Glossary of Symbols on page 167.

TABLE I.[2]

DISTANCE OF EXTREME FIBRES, MOMENTS OF INERTIA, AND RESISTANCE, SQUARE OF RADIUS OF GYRATION, AND AREAS OF DIFFERENT SHAPES OF CROSS-SECTIONS.

Number and Form of Section.	Distance of Neutral axis M.....N from extreme fibres.	Moment of Inertia i.	Moment of Resistance. r	Area. a.	Square of Radius of Gyration. ρ^2
1	$\frac{d}{2}$	$\frac{d^4}{12}$	$\frac{d^3}{6}$	d^2	$\frac{d^2}{12}$
2, 3	$\frac{d}{2}$	$\frac{bd^3}{12}$	$\frac{bd^2}{6}$	bd	$\frac{d^2}{12}$
4	$\frac{d}{2}$	$\frac{d^4-d_{,}^4}{12}$	$\frac{d^4-d_{,}^4}{6d}$	$d^2-d_{,}^2$	$\frac{d^2+d_{,}^2}{12}$
5, 6	$\frac{d}{2}$	$\frac{bd^3-b_{,}d_{,}^3}{12}$	$\frac{bd^3-b_{,}d_{,}^3}{6d}$	$bd-b_{,}d_{,}$	$\frac{bd^3-b_{,}d_{,}^3}{12(bd-b_{,}d_{,})}$
7	r	$\frac{11}{14}r^4$	$\frac{11}{14}r^3$	$\frac{22}{7}r^2$	$\frac{r^2}{4}$
8	r	$\frac{11}{14}(r^4-r_{,}^4)$	$\frac{11}{14}\frac{(r^4-r_{,}^4)}{r}$	$\frac{22}{7}(r^2-r_{,}^2)$	$\frac{r^2+r_{,}^2}{4}$
9, 10, 11, 12, 13	$\frac{d}{2}$	$\frac{bd^3-b_{,}d_{,}^3}{12}$	$\frac{bd^3-b_{,}d_{,}^3}{6d}$	$bd-b_{,}d_{,}$	$\frac{bd^3-b_{,}d_{,}^3}{12(bd-b_{,}d_{,})}$
13	$\frac{d}{2}$	$\frac{1}{12}(bd^3-b_{,}d_{,}^3-b_{,,}d_{,,}{}^3-b_{,,,}d_{,,,}{}^3)$	$\frac{bd^3-b_{,}d_{,}^3-b_{,,}d_{,,}{}^3-b_{,,,}d_{,,,}{}^3}{6d}$	$bd-b_{,}d_{,}-b_{,,}d_{,,}-b_{,,,}d_{,,,}$	$\frac{1}{12}\cdot\frac{bd^3-b_{,}d_{,}^3-b_{,,}d_{,,}{}^3-b_{,,,}d_{,,,}{}^3}{bd-b_{,}d_{,}-b_{,,}d_{,,}-b_{,,,}d_{,,,}}$

TABLE I.[1] (*Continued.*)

DISTANCE OF EXTREME FIBRES, MOMENTS OF INERTIA AND RESISTANCE, SQUARE OF RADIUS OF GYRATION, AND AREA OF DIFFERENT SHAPES OF CROSS-SECTIONS.

Number and Form of Section.	Distance of Neutral axis M.....N from extreme fibres.	Moment of Inertia i.	Moment of Resistance. r.	Area. a.	Square of Radius of Gyration. ρ^2
14	$\frac{d}{2}$	$\frac{1}{12}\left\{(b-z)d^3-b_1d_1^3-(b_{11}-z)d_{11}^3-b_{111}d_{111}^3-(b_{11}+b_{111})(d_{111}^3-(d_{111}-z)^3)\right\}$	$\frac{(b-z)d^3-b_1d_1^3-(b_{11}-z)d_{11}^3-b_{111}d_{111}^3-(b_{11}+b_{111})(d_{111}^3-(d_{111}-z)^3)}{6d}$	$bd-b_1d_1-b_{11}d_{11}-b_{111}d_{111}-z(d-d_{11})-z(b_{111}+b_{111})$	$\frac{(b-z)d^3-b_1d_1^3-(b_{11}-z)d_{11}^3-b_{111}d_{111}^3-(b_{11}+b_{111})(d_{111}^3-(d_{111}-z)^3)}{12\{bd-b_1d_1-b_{11}d_{11}-b_{111}d_{111}-z(d-d_{11})-z(b_{111}+b_{111})\}}$
15	$\frac{d}{2}$	$\frac{1}{12}\left\{(b-z)d^3-(b_1+b_{11})d_1^3-(b_{11}-z)d_{11}^3-b_{111}d_{111}^3-(b_{11}+b_{111})(d_{111}^3-(d_{111}-z)^3)\right\}$	$\frac{(b-z)d^3-(b_1+b_{11})d_1^3-(b_{11}-z)d_{11}^3-b_{111}d_{111}^3-(b_{11}+b_{111})(d_{111}^3-(d_{111}-z)^3)}{6d}$	$bd-(b_1+b_{11})d_1-b_{11}d_{11}-b_{111}d_{111}-z(d-d_{11})-z(b_{11}+b_{111})$	$\frac{(b-z)d^3-(b_1+b_{11})d_1^3-(b_{11}-z)d_{11}^3-b_{111}d_{111}^3-(b_{11}+b_{111})(d_{111}^3-(d_{111}-z)^3)}{12\{bd-(b_1+b_{11})d_1-b_{11}d_{11}-b_{111}d_{111}-z(d-d_{11})-z(b_{11}+b_{111})\}}$
16	$\frac{d}{2}$	$\frac{b}{12}(d^3-d_1^3)$	$\frac{b}{6d}(d^3-d_1^3)$	$b(d-d_1)$	$\frac{d^3-d_1^3}{12(d-d_1)}$
17	$\frac{d}{2}$	$\frac{d^3}{12}(b-b_1)$	$\frac{d^3}{6}(b-b_1)$	$d(b-b_1)$	$\frac{d^2}{12}$
18	$\frac{d}{2}$	$\frac{d^3(b-b_1)+b_1(d-d_1)^3}{12}$	$\frac{d^3(b-b_1)+b_1(d-d_1)^3}{6d}$	$d(b-b_1)+b_1(d-d_1)$	$\frac{d^3(b-b_1)+b_1(d-d_1)^3}{12\{d(b-b_1)+b_1(d-d_1)\}}$
19	$\frac{b_1^2+b_{11}\{x^2-(x-d_{11})^2\}+b_{111}y^2-(b-b_1)\cdot(y-d)^2}{3(bd+b_1d_1+b_{11}d_{11})}$	**Lower Fibres.** $\frac{b_1x^3+b_{11}\{x^3-(x-d_{11})^3\}+b_{111}y^3-(b-b_1)\cdot(y-d)^3}{3y}$	**Upper Fibres.** $\frac{b_1x^3+b_{11}\{x^3-(x-d_{11})^3\}+b_{111}y^3-(b-b_1)\cdot(y-d)^3}{3x}$	$bd+b_1d_1+b_{11}d_{11}$	$\frac{b_1x^3+b_{11}\{x^3-(x-d_{11})^3\}+b_{111}y^3-(b-b_1)\cdot(y-d)^3}{3(bd+b_1d_1+b_{11}d_{11})}$
20		$\frac{b_1x^3+b_{11}\{x^3-(x-d_{11})^3\}+b_{111}y^3-(b-b_1)\cdot(y-d)^3}{3}$			
21		**Lower Fibres.** $y=\frac{\frac{bd^2}{2}+b_1d_1\left(d+\frac{d_1}{2}\right)}{bd+b_1d_1}$	**Upper Fibres.** $x=\frac{\frac{bd^2}{2}+b_1d_1\left(d+\frac{d_1}{2}\right)+b_{11}d_{11}\left(d+d_1-\frac{d_{11}}{2}\right)}{bd+b_1d_1+b_{11}d_{11}}$		**Lower Fibres.** $y=\frac{\frac{b_1d_1^2}{2}+b_1\frac{d_1^2}{2}+bd\left(d+\frac{d}{2}\right)}{bd+b_1d_1+b_{11}d_{11}}$ where $x+y=d+d_1$ and $x:y=c:t$.
22		$x+y$ should be $=d+d_1$ and $x:y=c:t$, where c = ultimate resistance to compression, t = ultimate resistance to tension, per square inch.			
23					

[1] See Glossary of Symbols on page 167.

TABLE I.[1] (*Continued.*)

DISTANCE OF EXTREME FIBRES, MOMENTS OF INERTIA AND RESISTANCE, SQUARE OF RADIUS OF GYRATION, AND AREA OF DIFFERENT SHAPES OF CROSS-SECTIONS.

Number and Form of Section.	Distance of Neutral axis M.....N from extreme fibres.	Moment of Inertia i.	Moment of Resistance. r.	Area. a.	Square of Radius of Gyration. ρ^2
24	$\frac{d}{2}$	$\frac{(b-z)d^3-(b-z)d_1^3+b_1d_1^3}{12}$	$\frac{(b-z)d^3-(b-z)d_1^3+b_1d_1^3}{6d}$	$(b-z)d-(b_1-z)d_1+b_{11}d_{11}$	$\frac{(b-z)d^3-(b-z)d_1^3+b_1d_1^3}{12\{(b-z)d-(b_1-z)d_1+b_{11}d_{11}\}}$
25	$\frac{d}{2}$	$\frac{(b-b_1)\{d^3-d_{111}^3+(d_{111}-z)^3\}+b_1d_1^3-b_{11}d_{11}^3}{12}$	$\frac{(b-b_1)\{d^3-d_{111}^3+(d_{111}-z)^3\}+b_1d_1^3-b_{11}d_{11}^3}{6d}$	$(b-b_1)(d-z)+b_1d_1-b_{11}d_{11}$	$\frac{(b-b_1)\{d^3-d_{111}^3+(d_{111}-z)^3\}+b_1d_1^3-b_{11}d_{11}^3}{12\{(b-b_1)(d-z)+b_1d_1-b_{11}d_{11}\}}$
26	$\frac{d}{2}$	$\frac{b(d^3-d_1^3)+b_1(d_{11}^3-d_1^3)}{12}$	$\frac{b(d^3-d_1^3)+b_1(d_{11}^3-d_1^3)}{6d}$	$b(d-d_1)+b_1(d_{11}-d_1)$	$\frac{b(d^3-d_1^3)+b_1(d_{11}^3-d_1^3)}{12\{b(d-d_1)+b_1(d_{11}-d_1)\}}$
27	$\frac{d}{2}$	$\frac{bd^3+b_1d_1^3}{12}$	$\frac{bd^3+b_1d_1^3}{6d}$	$bd+b_1d_1$	$\frac{bd^3+b_1d_1^3}{12(bd+b_1d_1)}$
28	$\frac{d}{2}$	$\frac{bd^3-b_1(d_1^3-d_{11}^3)-zd_{11}^3}{12}$	$\frac{bd^3-b_1(d_1^3-d_{11}^3)-zd_{11}^3}{6d}$	$bd-b_1(d_1-d_{11})-zd_{11}$	$\frac{bd^3-b_1(d_1^3-d_{11}^3)-zd_{11}^3}{12(bd-b_1(d_1-d_{11})-zd_{11})}$
29	d	$\frac{bd^3}{3}$	$\frac{bd^2}{3}$	bd	$\frac{d^2}{3}$
30	d	$\frac{d^4}{3}$	$\frac{d^3}{3}$	d^2	$\frac{d^2}{3}$
31	d	$\frac{bd^3}{12}$	$\frac{bd^2}{12}$	$\frac{bd}{2}$	$\frac{d^2}{6}$
32	d	$\frac{bd^3}{4}$	$\frac{bd^2}{4}$	$\frac{bd}{2}$	$\frac{d^2}{6}$
33	Lower Fibres. $\frac{d}{3}$ Upper Fibres. $\frac{2}{3d}$	$\frac{bd^3}{36}$	Lower Fibres. $\frac{bd^2}{12}$ Upper Fibres. $\frac{bd^2}{24}$	$\frac{bd}{2}$	$\frac{d^2}{18}$
34	$\frac{b}{\sqrt{2}}=\frac{b}{1.4142}$	$\frac{b^4}{12}$	$0.1179\ b^3$	b^2	$\frac{b^2}{12}$
35	$\frac{d}{2}$	$\frac{d^4}{12}\frac{11}{14}r^4$	$\frac{d^3}{6}\frac{11}{7d}r^4$	$d^2-\frac{22}{7}r^2$	$\frac{7d^4-66r^4}{12(7d^2-22r^2)}$
36	r	$\frac{11}{14}r^4-\frac{d^4}{12}$	$\frac{11}{14}r^3-\frac{d^4}{12r}$	$\frac{22}{7}r^2-d^2$	$\frac{66r^4-7d^4}{12(22r^2-7d^2)}$
37	$\frac{d}{2}$	$\frac{\vartheta^4-\vartheta_1^4}{20}+\frac{h(bh^2+d^2-\vartheta^2)}{12}-\frac{h\{d_1^3-(d_1-z)^3-zh^2\}}{12}$	$\frac{\vartheta^4-\vartheta_1^4}{10d}+\frac{h(bh^2+d^2-\vartheta^2)}{6d}-\frac{h\{d_1^3-(d_1-z)^3-zh^2\}}{6d}$	$\frac{11}{14}(\vartheta^2-\vartheta_1^2)+2h(b-z)$	$\frac{7}{30}\left\{\frac{3(\vartheta^4-\vartheta_1^4)+5h(bh^2+d^2-\vartheta^2)-5h\{d_1^3-(d_1-z)^3-zh^2\}}{11(\vartheta^2-\vartheta_1^2)+28h(b-z)}\right\}$
38	$\frac{d}{2}$	$\frac{11}{224}bd^3$	$\frac{11}{112}bd^2$	$\frac{11}{14}bd$	$\frac{d^2}{16}$
39					
40	$\frac{d}{2}$	$\frac{11}{224}(bd^3-b_1d_1^3)$	$\frac{11}{112d}(bd^3-b_1d_1^3)$	$\frac{11}{14}(bd-b_1d_1)$	$\frac{bd^3-b_1d_1^3}{16(bd-b_1d_1)}$
41					
42 Corrugated Iron. Breadth of each sheet $=b$.			$\frac{4}{15}dbh$		

Refering back to Figure 1, we should have for Part I:—

$$i_1=\frac{11}{14}r_1^4.$$

For Part II we should have:—

$$i_{11}=\frac{b_{11}h_{11}^3}{12}$$

And for Part III:—

$$i_{111}=\frac{b_{111}h_{111}^3}{12}$$

[1] See Glossary of symbols on page 167.

For the distances of individual centres of gravity from main centre of gravity we should have for Part I: $d_i - d$.

For Part II: $d_{ii} - d$.

And for Part III: $d - d_{iii}$.

Therefore the moment of inertia, i, of the whole deck-beam would be: —

$$i = \left\{ (d_i - d)^2 . a_i + \frac{11}{14} r_i^4 \right\} + \left\{ (d_{ii} - d)^2 . a_{ii} + \frac{b_{ii} h_{ii}^3}{12} \right\} + \left\{ (d - d_{iii})^2 . a_{iii} + \frac{b_{iii} h_{iii}^3}{12} \right\}$$

But $a_i = \frac{22}{7} r_i^2$

Further, $a_{ii} = b_{ii}\, h_{ii}$,

And $a_{iii} = b_{iii}\, h_{iii}$, which, inserted above, gives for

$$i = \frac{r_i^2}{14} \left\{ 11 r_i^2 + 2(d_i - d)^2 \right\} + \frac{b_{ii} h_{ii}}{12} \left\{ h_{ii}^2 + 12 (d_{ii} - d)^2 \right\} + \frac{b_{iii} h_{iii}}{12} \left\{ h_{iii}^2 + 12 (d - d_{iii})^2 \right\}$$

CALCULATION OF STRAINS AND STRESSES.

As we have already noticed, the stress should exceed the strain as many times as the adopted factor-of-safety, or: —

$$\frac{\text{Stress}}{\text{Strain}} = \text{factor-of-safety.}$$

Or, stress = strain × factor-of-safety.

This holds good for all calculations, and can be expressed by the following simple fundamental formula: —

$$v = s . f \qquad (1)$$

Where v = the ultimate stress in pounds.
" s = " strain "
And where f = the factor-of-safety.

COMPRESSION.

In pieces under compression the load is *directly* applied to the material. In short pieces, therefore, which cannot give sideways, the strain will just equal the load, or we have: —

$$s = w.$$

Where s = the strain in pounds.
And where w = the load in pounds.

The stress will be equal to the area of cross-section of the piece being compressed, multiplied by the amount of resistance to compression its fibres are capable of.[1] This amount of resistance to compression which its fibres are capable of is found by tests, and is given for each square inch cross-section of a material. A table of constants for the resistance to crushing of different materials will be given later on.

In all the formulæ these constants are represented by the letter c.

We have, then, for the stress of short pieces under compression: —

$$v = a.c$$

Where v is the ultimate stress in pounds.
Where a is the area of cross-section of the piece in inches.
And where c is the ultimate resistance to compression in pounds per square inch.

Inserting this value for v, and w for s in the fundamental formula (1), we have for short pieces under compression, which cannot yield sideways: —

$$a.c = w.f, \text{ or: —}$$

$$w = a.\left(\frac{c}{f}\right). \qquad (2)$$

Where w = the *safe* total load in pounds.
Where a = the area of cross-section in inches.
And where $\left(\frac{c}{f}\right)$ = the *safe* resistance to crushing per square inch.

Example.

What is the safe load which the granite cap of a 12″ x 12″ pier will carry, the cap being twelve inches thick?

The cap being only twelve inches high, and as wide and broad as high, is evidently a short piece under compression, therefore the above formula (2) applies.

The area is, of course: $a = 12.12 = 144$ square inches.

The ultimate resistance of granite to crushing per square inch is, say, fifteen thousand pounds, and using a factor-of-safety of ten, we have for the safe resistance: —

$$\frac{c}{f} = \frac{15000}{10}, = 1{,}500 \text{ lbs.}$$

Therefore the safe load w on the block would be: —

$$w = 144.\ 1500 = 216{,}000 \text{ pounds.}$$

Where long pieces (pillars) are under compression, and are not secured against yielding sideways, it is evident they would be liable to bend before breaking. To ascertain the *exact* strain in such pieces is probably one of the most difficult calculations in strains, and in consequence many authors have advanced different theories and formulæ. The writer has always preferred to use Rankine's formula, as in his opinion it is the most reliable. According to this, the greatest strain would be at the centre of the length of the pillar, and would be equal to the load, plus an amount equal to the load multiplied by the square of the length in inches, and again multiplied by a certain constant, n, the whole divided by the "square of the radius of gyration" of the cross-section of the pillar. We have therefore for the total strain at the centre of long pillars: —

$$s = w + \frac{w.l^2 n}{\rho^2}$$

Where s = the strain in pounds.
" w = the total load in pounds.
" l = the length in inches.
" ρ^2 = the square of the radius of gyration of the cross-section.
" n = a constant, as follows: —

TABLE II.

Material of pillar.	Both ends of pillar smooth (turned or planed.)	One end smooth (turned or planed) other end a pin end.	Both ends pin ends.
Cast-iron	0.0003	0.0004	0.00057
Wrought-iron	0.000025	0.000033	0.00005
Steel	0.00002	0.000025	0.000033
Wood	0.00033	0.00044	0.00067
Stone	0.002		
Brick	0.0033		

The stress of course will be as before: —

$$v = a.\ c.$$

Where v = the ultimate stress in pounds.
" a = the area of cross-section in inches.
" c = the ultimate resistance to crushing per square inch.

Inserting the values for strain, s, and stress, v, in the fundamental formula (1) we have: —

$$a.\ c = \left(w + \frac{w.l^2.n}{\rho^2}\right) f.$$

or: —

$$a.\left(\frac{c}{f}\right) = w\left(1 + \frac{l^2 n}{\rho^2}\right)$$

or: —

$$w = \frac{a.\left(\frac{c}{f}\right)}{1 + \frac{l^2.n}{\rho^2}} \qquad (3)$$

Where w = the *safe* total load on the pillar.
" a = the area of cross-section in inches.
" ρ^2 = the square of the radius of gyration of the cross-section.
" l = the length in inches.
" $\frac{c}{f}$ = the *safe* resistance to crushing per square inch.

Example.

What safe load will a 12″ x 12″ brick pier carry, if the pier is ten feet long, and of good masonry?

The area of cross-section will be: —

$$a = 12.12 = 144 \text{ square inches.}$$

The square of the radius of gyration according to Section No. 1 in Table I would be: —

$\frac{d^2}{12}$, and as $d = 12$, we have $\rho^2 = \frac{12.12}{12} = 12$

For the safe resistance to crushing per square inch, we have, using a factor-of-safety of ten, and considering the ultimate resistance to be 2,000 pounds per square inch,

$$\left(\frac{c}{f}\right) = \frac{2000}{10} = 200 \text{ lbs.}$$

The length will be ten feet, or one hundred and twenty inches; therefore: —

$$l^2 = 14.400$$

For n we must use (according to Table II), for brickwork: —

$$n = 0.0033;$$

Therefore the safe total load on the pier would be: —

$$w = \frac{144.\ 200}{1 + \frac{14400.\ 0{,}0033}{12}} = \frac{28800}{1 + 3{,}96} = 5806 \text{ lbs.}$$

In all formulæ where constants and factors of safety are used, it will be found simpler and avoiding confusion to immediately reduce the constant by dividing it by the factor-of-safety, and then using only the reduced or *safe* constant.

Thus if $c = 48{,}000$ pounds, and if $f = 4$, do not write into your formula for $\left(\frac{c}{f}\right) = \frac{48000}{4}$, but use at once for $\left(\frac{c}{f}\right) = 12000$.

Materials in compression that have an even bearing on all parts of the bed will stand very much more compression to the square inch than materials with rough, uneven or rounded beds, or where the

[1] This is not theoretically correct, as there is in every case a tendency for the material under compression to spread; but it is near enough for all practical purposes.

bearing is on part of the cross-section only, as in the case of pins (in trusses) bearing on eye-bars. It is usual in calculating to make allowance for this. Columns with perfectly even bearing on all parts of the bed (planed or turned iron or dressed stone) will stand the largest amount of compression. Columns with rough, rounded or uneven ends are calculated the same as for pin-ends of eye-bars. In the table (II) giving the values for n of Rankine's formula for compression, the different values for smooth and also for pin ends are given.

[To be continued.]

COMMUNICATIONS

[*We cannot pay attention to the demands of correspondents who forget to give their names and addresses as guaranty of good faith.*]

WAXING GEORGIA-PINE FLOORS.

To the Editors of the American Architect: —

Dear Sirs,— Can you give me any information with regard to the usual effect of prepared-wax on Georgia pine? I have floored a house with clear Georgia pine, and given the floor two good coats of *hot* pure linseed-oil, allowing each to dry thoroughly, but the final coating of prepared-wax, from a reliable manufacturer, proves highly unsatisfactory. No amount of brushing removes a general muddy, streaked appearance. Can this be accounted for by the very small proportion of turpentine in the wax acting on the pitch in the pine? I see no remedy but scraping the floors and using a "hard-oil-finish."

Any information you can give me with regard to pitch-pine floors which have been successfully waxed, may be appreciated by others than Yours, very respectfully, ———

[Our correspondent has suggested a very probable cause of the mischief, but we believe the trouble began with the application of the "hot" oil, which must have softened the resinous particles in the wood. If the flooring had been "sap-run," which, of course, ought not to have been the case, the use of hot oil would have been judicious. — Eds. American Architect.]

GROWTH OF ARCHITECTURAL FORMS.

To the Editors of the American Architect: —

Dear Sirs,— Buildings of all kinds and in all ages originate, grow into form, and are finished in two ways — from within out, and from without in: comparatively, as in the vegetable kingdom, there are two forms of growth — endogenous, forms produced from within; exogenous, forms produced from without. The grasses, corn-stalks, wheat, reeds, palm-trees, grow from the inside, while our common trees and shrubs grow from the outside.

An old-fashioned country barn grew from the inside out. The farmer wanted a room to stow away hay in, and so he planned the inside just as he wanted to have it to suit his purpose — made a bay long enough, wide enough, and high enough, etc. and then let the outside look as it might — an endogenous growth.

Our finest country cottages of to-day grow from the outside in: the architect thinks how the cottage will look to people outside: an exogenous growth.

Cleaving off their steeples and front ends clear to the ground, Park Street Church and the Old South exhibit the old country barn architecture: they are wood-and-brick shells put over the extremely important inside. Later churches in Boston have an outside beauty as well as an inside beauty.

Grecian temples were especially beautiful outside. Solomon's Temple grew from the inside, and its outside form was accidental; it might have happened to be beautiful, and it might have happened to be ugly. The restorer had nothing to do with either its inside or its outside looks. His duty was to have no theory about either the form or appearance of this or any other Holy House: he was bound by oath of fidelity to truth to draw as he was ordered by the description according to his understanding of it after years of study. A restorer of lost forms, like any other scientific man, has no right to have an opinion, a notion, a view, or to be ingenious: he must get at the best results he can, and then give them just as they are — beautiful or ugly, pleasing or not.

But is the front end of the temple, as restored, ugly? We must not judge a piece of a thing, cut out and off, and looked at alone. Turn to Plate H, the first in "*The Holy Houses, or Solomon's Temple*," and put any other form you see in place of the Central House and see if your form will look better than the one there given. First, the flat-roofed house is in a whole country of flat-roofed houses: a Grecian roof would not do there, however beautiful in itself. Second, that house is in the midst of a great system of forms that are in harmony. The Outer Court with its three gates forms the lowest member of the system: a low, wide-spread plateau, nine hundred feet square. The Inner Court with its three gates forms the middle and higher member: a wide-spread, low plateau, six hundred feet square. The Central House with its two groups of priests' houses, the sea, and altar, form the uppermost member occupying a surface three hundred feet square. That is, the vast group or system of structures as a whole grew narrower and narrower, or smaller and smaller upwards in three stories. In details, every one of the six gates grew narrower and narrower inward, or towards the Central House, in three portions — not in vertical height only, but especially in ground plan. Next, the altar grew smaller and smaller upwards in three stories, and every one of the thirty little buildings, on the right and left of the Central House, grew smaller upwards in three stories.

Thus far all the forms described grew smaller and smaller upwards in three stories, or smaller and smaller inwards.

Does not this system need some balance, some exception? The central house is very much the largest single form: in fact, just exactly large enough to balance all the small forms on both courts; and it grows larger and larger upwards in bolder and bolder outjuts. No other form will fit in here, and hence it demands acceptance.

That the Temple grew *from within* is a fact easily proved. We first notice that in the Kings (Chapt. vi.) description every measure is an inside one; all outside measures are in Ezekiel, with many inside ones.

But the history of the temple-forms in the Central House is this: The amount of text in the commandments given on Mount Sinai required two stone slabs, each two cubits by one. These required a chest two and a half by one and a half. A room, the Holy of Holies, was made to receive this chest or ark. In front of this room was a second, and a court surrounded the little house (tabernacle) that had these two rooms in it. The temple followed the tabernacle and gave rise to the ground-floor room of the temple, seen best in Plate G′ (G prime). The Galleries of Arms of David's wars were added around two sides and the west end. These galleries were so formed as to receive the arms; one high wall was cut up into many low walls, as best seen in Plate G (not G prime): and it is these galleries, produced by inside needs, that give the flat face of Plate G 2

The front porch was added as a fan, or sun and storm shade over the three doors and the winding stairs. Almost nobody could go into the temple; and this porch was enough. According to the Septuagint a great tapestry veil filled all the space between Jachin and Boaz, as seen in Plate M. Ezekiel tells us also that the very place in which this veil hung was called the TENT (not "tabernacle" of our English Bibles); and a cloth veil would warrant the term "tent." Thus a shallow porch (sixteen and one-half feet deep) would be deep enough, being closed against storm by the tapestry.

The front porch of the Capitol needed to be larger, because the royal court must enter thereby; and it was nearly six times as large as the front porch of the temple (Plate G9).

Author of the "*Holy Houses, or Solomon's Temple.*"

NOTES AND CLIPPINGS

The Electric Light in Light-houses. — The recent experiments at the South Foreland on light-house illumination by means of electricity, give particular interest at this time to the following considerations on the subject by H. Lucas, delivered to the French Academy of Sciences. In the French light-houses lit by the voltaic arc, such as those of Dunkirk, Calais, Griz-nez and others, four horse-power engines are employed to produce a light of 450 *becs carcel*. The current is 55 ampères, the resistance of the arc 0.43 ohms, and the difference of potential between the carbon-points is 23.65 volts. It follows that, of

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Glossary of Symbols. — The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.: —

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches.
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars.
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches.
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches.
$\mathfrak{D}$ = *diameter*, in inches.
$\mathfrak{r}$ = *radius*, in inches.
μ = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b. b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance: —

m = moment or bending moment at *centre*.
m_{A} = " " " *point A*.
m_{B} = " " " *point B*.
m_{X} = " " " *point X*.
s = strain at *centre*.
s_{B} = " *point B*.
s_{X} = " *point X*.
v = stress at *centre*.
v_{D} = " *point D*.
v_{X} = " *point X*.
w = load at *centre*.
w_{A} = " *point A*.

the four horse-power absorbed, only 1.76 are utilized in the arc, the rest being taken up in belting and the machinery. The voltaic arc presents two advantages over mineral-oil lamps for light-house purposes, namely, greater power of penetrating the atmosphere, and less cost per unit of light; but, in the opinion of M. Lucas, the flickering of the arc is a drawback, and it is due rather to the movement of the bluish light of the arc round the glowing points, than to the changes in length. He therefore suggests what, by the way, has been suggested before in this country, that a purely-incandescent light should be used. The conditions which this light should fulfil are: (1) The focus of light ought to present the form of a surface of revolution having a vertical axis, so that the light be equally distributed in all azimuths. (2) The use of quantity-current, of low electro-motive force. (3) The incandescent-wick, or electropyre, should be of carbon, because it can withstand very high temperatures. From an investigation which he has made, M. Lucas finds that 400 *becs carcel* can be obtained with a current of 170 ampères and a resistance of 0.04 ohms of incandescent-carbon; or, in other words, with an electro-motive force of 7 volts and 1200 watts of energy. Under these conditions the unit of light does not require for the incandescent-wick more mechanical power than the voltaic-arc used now in French light-houses. The temperature of the carbon is estimated at 4000° Centigrade. It is known that a smoke of carbon, deposited on the glass of incandescent-lamps, in time cuts off the light of the filament; and M. Lucas attributes this to the oxygen in the bulb, the rapidity of the deposition being in proportion to the pressure of the gas inside. The oxygen combines with carbon near the junction of the latter with the metal electrodes, and the carbonic-oxide formed is dissociated at the hotter parts of the carbon, leaving the carbon-particle free to deposit on the glass. M. Lucas comes to the conclusion that, in order to secure a high vacuum, the gases emitted by the solids in the lamp should be absorbed by an absorbent within the bulb. Otherwise it will not be easy to prevent the deposition of carbon-dust on the interior of the glass-envelope. — *Engineering.*

Reclaiming Lands in Florida. — The Disston Land and Improvement Company is doing some marvellous work in Florida, in redeeming thousands of acres of land which are now under water. Already immense tracts have been thus made available, and it has been demonstrated that there is no better land in the State than that thus reclaimed. The company operates under a law of the State which allows it one-half of the land rendered available, and expects to reap a rich harvest before it finishes the improvements contemplated. The South Florida Railroad, from Sanford to Tampa, crosses the State on a dividing-ridge, and from this ridge, looking south, there is a continual, but gradual depression in the land to the southern extremity of the State. The land to the south of this ridge is different from that on its north, in that it is not at all undulating, but spreads out in a vast plain, gradually inclined toward the north. The Disston Company is utilizing this work of nature. Lake Kissimmee is in the midst of a series of lakes, and its northern point just touches the South Florida Railroad at Kissimmee City. This lake is a very long and narrow one, reaching toward Lake Okeechobee, with which it has been connected by canalling the intervening series of lakes. The lakes around Kissimmee have been connected to it by canals, giving a continual outlet to Okeechobee. Thus the areas of these lakes are lessened by the immense flow which finds its way to Okeechobee, and from thence to the Gulf on one side, and to the Atlantic on the other, canals reaching from the immense lake to these two great bodies of water on each side. By this canalling process the level of Lake Kissimmee has been lowered six feet, and that of the lakes surrounding it proportionately. In this manner the Disston Company proposes to reclaim thousands of acres of land, one-half of which will go to the State, and the other half to the company. The land which is thus made useful is not only that immediately surrounding these lakes, but extends in many places over miles of swampy bottoms. Since these lakes have been connected it is now an easy matter to start by boat in Lake Kissimmee, in the centre of lower Florida, and proceed by water through Lake Okeechobee to either the Atlantic or the Gulf. It is said that Georgia's great swamp, the Okefenokee, can be as easily reclaimed. This immense morass, forming a distinct basin much lower than the surrounding country, is, at its lowest point, within but a few miles of the St. Mary's River, the level of which is below that of the swamp. These two, connected by canal, the great Okefeenokee is drained, and a magnificent area of land is ready for the plough. It is only a question of time. — *Atlanta (Ga.) Constitution.*

The West Front of Milan Cathedral. — An international competition is advertised in the Italian papers for a design for a new west front to the cathedral at Milan. No fewer than fifteen premiums are offered, of a total value of £3000. The designs will be adjudicated upon by a jury of architects of different nationalities.

TRADE SURVEYS

There is no good reason for indulging in pessimistic views on account of the unfavorable developments of the past week or two. Some business which ought to have been transacted is withheld; a few million dollars' worth of orders covering material of all kinds, which should have been placed, have not been placed; transactions which might foot to a few million dollars in real estate, have not been terminated, simply because of the spirit of indifference which has been permitted to creep into business channels. The fundamental conditions are as favorable and as promising as they have been at any time during the past six months. The labor question is the only really unsettling question in business; it is, of course, possible for the labor strikes to assume an aggravated form, and involve interests which have thus far escaped and lay the foundation for mischief, which so far has been avoided. The laborers everywhere are anxious to resume work, and if Bradstreet's estimate of the number idle is correct, the matter is a very trifling one. The Southwestern strike will not be permitted to cross the Mississippi River, if labor leaders and railway managers can prevent it. At present writing, the bituminous miners' strike is likely to continue and extend to fields not now affected. This strike properly understood, however, is simply an effort to restore wages to what they were, and to exact a fulfilment of promises given by employers as a consideration for the acceptance of lower wages a year or eighteen months ago. Labor troubles elsewhere are quieting down. At no time for years has there been so little disemployment. At no time since 1882 has there been as much business in hand and in sight. The underlying facts and conditions and tendencies when shorn of all their poetry prove that a heavy volume of business is crowding upon our various markets. A summary of the real estate transfers in New York, Brooklyn, Philadelphia, Pittsburgh and Chicago shows that the same activity prevails and that real estate is holding its own without difficulty. Building operations are being entered upon with something but little short of enthusiasm, if that term is admissible. Within a week or ten days considerable manufacturing has been projected. A great deal of it is in smaller towns. There seems to be an inclination among a great many of the smaller manufacturing concerns springing up to avoid the larger cities, possibly because of the stricter labor control exercised in them and partly because of high taxation. Whatever the reason may be, the smaller towns are preferred because of the equal facilities afforded for transportation. The railroad companies are making traffic rates designed to stimulate the development of manufacturing in small towns. During the past few days a large number of public buildings, banks, educational institutions, places of amusement, and large stores have been projected. The interior of Pennsylvania seems to be animated with the genuine building fever. In Reading, Pottsville, York and Lancaster, there is particular activity. The advantages afforded by cheap coal and lumber and cheap labor are being appreciated. It is unnecessary to select a particular locality in order to find evidences of industrial thrift or building activity. It is more difficult to find evidences of inactivity. The iron trade, which may be taken as a fair barometer of trade conditions generally, is, in spite of several drawbacks, in an improving condition. This is due in part to the fact that it has been and is nearly absolutely free from labor agitations. In Eastern Pennsylvania, mills and furnaces are oversold for months. One or two exceptions should be noted, namely, bar-iron and plate-iron. These exceptions are due in part to the steady inroads of steel of various makes, which are destined to supplant numerous kinds of iron. In Western Pennsylvania there is more vigor in the iron trade; a large amount of business has been transacted within a week; a new $1,000,000 mill is being erected there, and our special information is to the effect that the enterprises contemplating removal to that city and vicinity will increase the value of the manufacturing plant some $20,000,000 within the next six or eight months, provided the contemplated projects are carried out. The entire natural-gas belt is being visited and investigated by manufacturing interests. The coal syndicate made a combination to extend one year and advanced prices. Stronger prices are probable in several branches of the iron trade. The same favorable conditions exist in the more Western markets, but there is nothing to alarm consumers of iron and steel, as to the probability of much higher prices. Our latest advices from Michigan lumber centres and from Savannah, Pensacola, and one or two other lumber-shipping points in the South confirm the views heretofore expressed, as to abundant supplies and steady prices. The consumption of yellow pine is steadily increasing, and it is being applied to a greater variety of special uses. A large amount of business has been done in all Atlantic cities from Boston to Baltimore for spring and summer deliveries, and large shipments are now on their way to fill urgent orders. Three or four extensive yellow pine purchases have been about consummated in Florida and Georgia. The low freight-rates from the Pacific coast has created an exceptionally active demand for California redwood. Methods of manufacturing lumber upon the Pacific coast have recently been improved, and the lumber interests there are earnestly seeking an Eastern outlet. Builders have not been called upon to pay higher prices this year than last throughout the New England and Middle States; dealers are more anxious to do a large business than to exact the highest possible prices. White pine is abundant and is held at a slightly higher figures in the West, but thus far, when the lumber comes East it finds its way into dealers' yards, at about old figures; this is due perhaps to the liberal supplies in nearly all the yards, both in tide-water cities and in lake ports within easy reach. An estimate of the log cut upon the upper Mississippi to be sawed in the mills north of Minneapolis has been recently put at 335,000,000 feet. The estimated shortage for Minneapolis mills was put at 27,000,000 feet. Western dealers endeavor to argue that higher lumber prices are inevitable, but in the case of yellow pine no such claims are made, while in the case of hemlock, shipments are virtually in the hands of railroad companies who have damaged that lumber very seriously by discriminating rates. Hard woods of all kinds are showing some signs of scarcity, especially for dry lumber. The old districts are unable to render any assistance to the markets, and new territory is being brought within reach of market by railway construction and by the erection of saw-mills. The sash, door and blind factories are generally low in stocks in the East. Western factories have nearly all the work they can handle. The uncertainty as to the cost of labor, and to some extent as to the cost of material has checked what would otherwise have by this time developed itself into quite a bitter competition; as it is, building material of all kinds and manufacturers' supplies are being held at firm prices. There is a probability of development of some interesting competition between these interests in the event of the settlement of labor disturbances favorably to employers; at present nails are held at 2.40 to 2.50; merchant bar at one and one-half to two cents per pound; plate-iron at two cents; sheet-iron at three and one-half to four; tin-plate is without fluctuation; lath and shingles are held very firmly, but more abundant supplies will likely weaken prices within thirty days. In cements, paints, oils, etc., no change has taken place. Manufacturers are busy, and stock will be abundant; window-glass is likely to improve somewhat in price if the statements are correct as to the Belgian supplies. The American factories will run full time to the end of the season.

Museum of Antiquities at Athens. — All the scattered antiquities of Athens will be brought together in the Central Museum, with the exception of statues and reliefs that belong to the Acropolis. The latter will remain in their special museum. All inscriptions go to the Central Museum. The latter is to be arranged historically, and the gaps made by antiquities which have left Greece and been preserved elsewhere will be filled by plaster-casts. The Acropolis and Central Museum will be free to the public on Saturdays and Sundays; on other days one franc will be charged. Drawings of objects may be taken, but squeezes and photographs are a Government monopoly, which will be sold or permitted to be taken as special favors. — *New York Times.*

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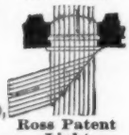

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BUILDING INTELLIGENCE.

Reported for the American Architect and Building News.

Alterations.

Providence, R. I.—Alteration to frame dwell., Broad St.; owner, G. Manchester; builder, J. F. Arnold.

Frame addition to store; owner, Wm. Wilkinson; architects, Stone, Carpenter & Wilson.

Frame addition, 6 Mechanics Ave.; owner, Ellen McAllen; built by day work.

Red Bank, N. J.—The store of Messrs. Adlem & Cole is to be remodelled, and an entirely new front of mahogany built, from plans of Mr. Henry F. Kilburn, of New York.

Apartment-Houses.

New York, N.Y.—*Eighth Ave.*, n w cor. One Hundred and Twenty-ninth St., five-st'y brick flat, flat tin roof; cost, $20,000; owner, Henry Gerken, 1454 Third Ave.; architect, John Brandt, 1491 Third Ave.

One Hundred and Thirteenth St., s s, com. 45′ e Madison Ave., 4 five-st'y brick flats, flat tin roof; cost, $80,000; owner, John S. Scott, 47 East One Hundred and Twelfth St.; architect, John C. Burne, 1521 Third Ave.

Ninth Ave., w s, 25′ n Ninety-eighth St., 3 five-st'y brick flats, flat tin roof; cost, $66,000; owner, John H. Haaren, 338 Greenwich St.; architect, John C. Burne, 1531 Third Ave.

Ninth Ave., w s, 100′ n Ninety-eighth St., five-st'y brick flat, flat tin roof; cost, $23,500; owner, John W. Haaren, 338 Greenwich St.; architect, John C. Burne, 1531 Third Ave.

East Sixty-first St., Nos. 342-344, 2 five-st'y brick flats, flat tin roof; cost, $33,000; owner, William Dettmar, 2067 Second Ave.; architect, Julius Kastner, 744 Broadway.

West Forty-eighth St., No. 342, five-st'y brick flat, flat tin roof; cost, $20,000; owner, Alexander Cadoo, 415 West Forty-eighth St.; architect, John Miller, 335 Broadway.

Ninety-eighth St., n w cor. Ninth Ave., *Ninety-ninth St.*, s w cor. Ninth Ave., 2 five-st'y flats, flat tin roofs; cost, $52,000; owner, John W. Haaren, 338 Greenwich St.; architect, John C. Burne, 1531 Third Ave.

Madison St., No. 400, five-st'y brick flats, flat tin roof; cost, $20,000; owner, Patrick McManus, 110 East Ninetieth St., architect, John C. Burne, 1531 Third Ave.

Morton St., Nos. 9 *and* 11, 2 five-st'y brick flats, flat tin roofs; cost, $40,000; owners, Henry M. Tostwin, 204 East Fifteenth St.; John I. Roberts, 185 West One Hundred and Twenty-ninth St., and Geo. Orr, 2020 Third Ave.

Seventy-seventh St., n s, 80′ w Second Ave., 2 five-st'y brick flats, flat tin roofs; cost, $36,000; owner, F. R. Frech, Staten Island; architect, Henry Haal, 338 East Seventy-eighth St.

One Hundred and Sixth St., s s, 225′ e Ninth Ave., 2 five-st'y brick flats, flat tin roofs; cost, $40,000; owner, Ellen Powers, 522 West One Hundred and Fifth St.; architect, M. V. B. Ferdon, 16 Morton St.

Sixth Ave., n w cor. One Hundred and Thirty-first St., five-st'y brick flat, flat tin roof; cost, $25,000; owners, Lynch & Bierhaff, 270 West One Hundred and Twenty-seventh St.; architect, Theo. E. Thomson, n e cor. Eighth Ave. and One Hundred and Twenty-fifth St.

Tenth Ave., w s, 50′ s Seventy-fifth St., 2 five-st'y brick flats, flat tin roofs; cost, $40,000; owners, Lowen & Halliday, 514 West Sixtieth St.; architects, Thom & Wilson, 1267 Broadway.

West One Hundred and Twenty-third St., No. 251, five-st'y brick flat, flat tin roof; cost, $17,000; owner, Catharine Lowe, 251 West One Hundred and Twenty-third St.; architect, Fred R. Usher, 2294 Eighth Ave.

Factories.

New York, N. Y.—Mr. Henry Iden will build a factory at Nos. 541-547 Pearl St.

Messrs. A. L. Fauchere & Co., will erect a five-st'y factory, 98′ front, w s Eleventh Ave., between Thirty-fourth and Thirty-fifth Sts., from plans of Messrs. Kimball & Ihnen.

Mr. Bart. Walther will build a two-st'y office and store-building, 25′ x 70′, s s One Hundred and Twenty-fifth St., bet. Second and Third Aves.

Clinton St., No. 66, three-st'y brick factory, flat tin roof; cost, $8,000; owner, Charles Smith, 190 Stanton St.; architect, William Graul, 215 Bowery.

Fifty-third St., n s, 100′ 4″ e Second Ave., six-st'y brick factory, flat tin roof; cost, $30,000; owner, Adolph Kerbs, cor. Fifty-fourth St. and Second Ave.; architects, D. & J. Jardine, 1262 Broadway.

Providence, R. I.—Frame manufactory, 89 Aborn St.; cost, $4,000; owners, R. I. Braid Machine Co.; builders, Ide Bros.

Houses.

Baltimore, Md.—W. P. Clotworthy, 4 three-st'y back building, w s Stricken St., s Pressman St.

J. C. Griffin, 19 two-st'y back buildings, s s Wilkens Ave., bet. Monroe and Payson Sts.

John Ward, three-st'y back building, s s Chase St., e Valley St.

The Woman's Hospital of the State of Maryland, three-st'y back building, w s John St., n Townsend St.

S. P. Morton, three-st'y back building, s s Pierce St., bet. Pine and Pearl Sts.

Jas. Millar, Jr., three-st'y back building, e s Caroline St., bet. Preston and Hoffman Sts.

Geo. C. Hershman, 7 two-st'y back building, s s Jefferson St., bet. Madeira Alley and Patterson Park Ave.

P. Dougherty, three-st'y back building, s s Warren St., bet. Henry St. and the water.

Louis Knoche, 3 two-st'y back buildings, n s Granby St., w Central Ave.

Minneapolis, Minn.—R. G. Berglund, 9 two-st'y brick veneer dwells., 3029-45 Seventeenth Ave. s; cost, $10,800.

R. G. Berglund, 6 two-st'y brick veneer dwells., 3030-40 Eighteenth Ave. s; cost $7,200.

A. Olson, double two-st'y brick veneer dwell., 2400-2 Tenth Ave. s; cost, $7,500.

O'Connor & Brooks, two-st'y wood dwell., 2739 s; Dufont Ave.; cost, $4,000.

P. Sanden, two-st'y wood dwell., 917 Fifteenth Ave. s; cost, $3,000.

J. O. Lee, two st'y wood dwell., 2424 Tenth Ave. s; cost, $3,500.

C. F. Bremer, two-st'y wood dwell., 2917 Sixty-first Ave. s; cost, $3,300.

E. Siskron, two-st'y wood dwell., 1908 Pleasant Ave.; $3,500.

R. M. Riner, two-st'y wood dwell., 2522 Portland Ave.; cost, $3,500.

Wm. H. Purdy, two-st'y dwell., 1029 First Ave. s; cost, $4,500.

J. Lyons, three-st'y brick boarding-house, 25 East Main St.; cost, $6,500.

Hugh Longstaff, 5 two-st'y wood tenements, 2171 Third Ave. n; cost, $3,000.

New York, N. Y.—*Morris Ave.*, w s, 50′ s One Hundred and Sixty-second St., two-st'y and basement dwell., flat tin roof; cost, $4,000; owner, Charles Schaufelberger, 726 Third Ave.; architect, Adolph Pfeiffer, 891 North Third Ave.

Eagle Ave., w s, 326′ s West Chester Ave., three-st'y brick and frame dwell., flat tin roof; cost, $3,000; owner A. E. Fergusson, 140 East Twenty-eighth St.; architect, J. Anderson, 718 East One Hundred and Fourty-fourth St.

West Fifty-first St., No. 227, four-st'y brick dwell., tin roof; cost, $12,000; owner, Mrs. Letetia Striker, 229 West Fifty-first St.; architect, John H. Duncan, 237 Broadway.

South Kingman, Kans.—Hon. F. E. Gillett will build a $5,000 house near the site of his present home.

Labor.

Boston, Mass.—The following articles of agreement between the master roofers and the Roofers' Assembly, Knights of Labor, 4889, signed by most of the master roofers in this city, will go into effect April 1, in the shops of the signers:—

Article 1.—Sect. 1. No firm shall discriminate, in hiring or discharging employés, for or against the Roofers' Assembly, Knights of Labor; nor shall the Roofers' Assembly or their representatives demand that such discrimination be made.

Sect. 2. It is agreed that in all cases the firm be its own judge of the competency of the workmen in its employ.

Sect. 3. No person shall be hired to displace another at less than the regular rates as hereby agreed upon.

Sect. 4. A day's work shall consist of 10 hours, except Saturday, when 8 hours shall constitute a day's work, the workmen to stop work Saturday at 4 o'clock, P. M., and to be paid punctually at that hour; no reduction to be made in wages on account

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BOOK NOTES.

THE Hon. George H. Monroe ("Templeton," of the *Hartford Courant*), says: "I know nothing in literature more absolutely faithful than is her portrayal. She imbues it all with such a delicious humor, too!"

Building says, of "The State Capitol at Hartford, Conn." (Monographs of American Architecture, No. 2): "The book is one which should be on the library-table of every architect. The publishers have evidently spared no effort to make the volume perfect in all respects."

REV. SAMUEL LONGFELLOW has the gratification of knowing that the four thousand copies of his brother's life, composing the first edition, are all sold, and that of the special *édition de luxe* not a copy remains unsubscribed for, while the price has advanced from $12 to $20 at the retail book-shops.

MR. HOWELLS says, in the Editor's Study of the April *Harper's Magazine:* "And again we say the book, as a whole, is very clever. . . . The temper of the book is romantic, but many of its phases are naturalistically studied; the women-figures are very well done; the men-figures are such as women draw, except always the handsome, boyish scamp-husband; he is a triumph." This is said about "The Story of Margaret Kent," of which the sixth thousand is now ready.

THE *Japan Gazette*, of Yokohama, gives an additional review of over two columns to Percival Lowell's "Chosön: the Land of the Morning Calm," saying: "Indeed, Mr. Lowell's book is a great deal more than a mere narrative of residence in Korea. It goes to the bottom of the whole question of the three far-Eastern nations, China, Japan and Korea. . . . Fortunately for the subject, it has been taken in hand by one who had the *verve* of youth, allied with the curiosity of the scientist. These serve as torches, that light up with a picturesque beauty the cavernous recesses of the Hermit 'Kingdom.'"

ROSE TERRY COOKE'S new book of New-England Stories, "The Sphinx's Children," is calling forth extended comment. Arlo Bates writes as follows, in the *Boston Courier:* "A correspondent, signing herself X, writes to the *Advertiser* in an absurd panic, lest, 'in honoring Mrs. Rose Terry Cooke, we shall, as in Hawthorne's case, wait until *Old* England tells *New* England what a genius she is neglecting.' As it has for years been generally recognized and heartily acknowledged that Mrs. Cooke has written the best stories of New-England country-life ever published, the fear of 'X' seems somewhat needless. If 'X' kept better informed upon literary matters, she would be less alarmed for the reputation of the author she admires."

THE *New York Commercial Advertiser* has this to say of Isaac Henderson's new novel, "The Prelate": "And the characters have the prime merit of being interesting, and that means worth writing about and reading about. The author has taken the revival of the 'old Catholic' movement, with its protest against the modern infallibility business and similar ventures as a *leitmotiv*, and in the efforts of the Jesuitical order to preserve its secrets and its power, he finds abundant material for very intricate and dramatic situations. These the writer handles with the skill of no novice. The topographical elements are very properly handled; no book about Rome could well fail of some degree of the charm that always lies about the imperial city."

GEORGE CARY EGGLESTON, in the *New York Commercial Advertiser*, thus commends Mr. Howells's latest book: "'Indian Summer,' in that its characters are a more cultivated lot than those in 'Silas Lapham,' will, perhaps, find more friends, and those who have followed Mr. Howells's career with any closeness, will think they detect a gain in the refinement of the artist's touch. There is less elaboration and emphasis to insure the grasping of a point. There is more reliance on the under-current, which seems to come, not by conscious act of the author, but by the necessities of the situation he has created. . . . *The person who cannot enjoy 'Indian Summer,' and read it over and over, is a fit subject for tender treatment and gentle commiseration*"

THE bright little *Book-Notes*, of Providence, thus describes Maturin M. Ballou's "Edge-Tools of Speech": "It is a large collection of condensed expressions of thought on a great variety of subjects, by the most distinguished, or profound writers of all ages. It is arranged by subjects. Take the word *Novel*, by which we mean a fictitious story. This book gathers short, pithy expressions concerning it by Herschel, Goldsmith, Emerson, Sir Walter Scott, Thackeray, Dryden, Carlyle, Sala, Beecher, Willmott, Hamerton, Fielding, Swift, Macaulay, Sterne, Masson, Balzac, George Curtis, and others. It is not within the range of possibility for any reader to have read all these writers. Even had he done so, how could he remember just where to turn to these authors to find their thoughts, and yet how convenient it is for a writer, or a speaker, to have quick access to them for illustrations. This book, for the uses for which it was made, is excellent."

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BUILDING INTELLIGENCE.

of the short days of winter, the pay for Saturday to be the same as the schedule calls for.

SECT. 5. Pending the discussion of any dispute, there shall be no lockout, strike, stoppage or cessation of work or business, on the part of employer on employés on account of said dispute.

SECT. 6. If any dispute should arise between employer and employés, said dispute shall be settled by arbitration.

ARTICLE 2.—SECT. 1. It is agreed that the signers of these articles shall be placed on as low a scale of prices as any with whom the Roofers' Assembly K. of L., shall treat.

SECT. 2. It is further agreed that the Roofers' Assembly, K. of L., shall, as far as possible, enforce a scale of prices not less than those hereinafter agreed upon in all shops engaged in the slate, metal and composition roofing in Boston and vicinity.

SECT. 3. The above articles of agreement, with price list of labor hereunto annexed, shall govern the relations of the firms signing and accepting the same with the Roofers' Assembly, Knights of Labor, 4889, of Boston, until the first day of April, 1887. If the Assembly should want to change the prices and time of labor after the 1st of April, 1887, they shall give the master roofers three months' notice before that time; and if the master roofers wish to make a change at that time, they shall give the Roofers' Assembly three months' notice before the above said time, meaning the 1st day of April, 1887.

BUILDING INTELLIGENCE.

ARTICLE 3.—SECT. 1. The following schedule rates of pay are adopted: On and after the 1st day of April, 1886, the wages shall be as follows:—

Slate and metal roofers per day, $3.

Composition roofers, per day, $2.25 to $3.

[Refer to Art. 1, Sect. 2, for information in regard to grading this pay].

Tenders and helpers, $2.25 per day.

For the Roofers' Assembly, K. of L., 4889.

FRED. A. DEMOND,
GEORGE F. FULLER,
TIMOTHY J. SHEEHAN,
Committee.

DANBURY, CONN.—All but one of the builders in Danbury have signed an agreement that 59 hours' shall be a week's work for the carpenters, 10 hours on every day but Saturday, when there shall be 9.

VINALHAVEN, ME.—An Arbitration Committee from the Knights of Labor and the Bodwell Granite Co., have arranged a schedule of wages for the granite company's employés, which goes into effect April 1. The company employs 400 men. The new scale of wages shows an increase of from 10 to 15 per cent over the present rates, and a reduction of hours of labor on Saturday from 10 to 8, without loss of pay. Under the new scale cutters are to receive not less than $2.75 per day; sharpeners, $2.60; teamsters, from $1.85 to $2.25; quarrymen, from $1.75 to $2.00; laborers, $1.65; boxers, $1.75; engineers and polishers, are increased the same as quarrymen over the old rates; carmen, $2.00 per day; dray tenders, $1.70 to $1.80; paving cutters, an advance of about 25 cents per day.

BUILDING INTELLIGENCE.

Stables.

BROOKLYN, N. Y.—*Rutledge St., No.* 98, s s, 200′ w Bedford Ave., two-st'y brick stable, tin roof; cost, $1,000; owner, J. Probst, Bedford Ave., Penn St.; architect, A. Herbert; builder, not selected.

Boerum St., s s, 100′ w Lorimer St., two-st'y frame (brick filled) stable and dwell., tin roof; cost, $1,080; owner, John H. Dammann, on premises; architects, Platte & Acker; builder, H. Tietjen.

Sumner Ave., e s, 70′ 2″ n Halsey St., two-st'y brick stable; cost, $1,200; owner, Daniel Norris, 359 Clifton Pl.; architect, J. D. Hall; builder, F. B. Norris.

President St., s s, 171′ e Fourth Ave., two-st'y brick stable; cost, $1,400; owner, architect and builder, Augustus Shuck, on premises.

NEW YORK, N. Y.—*One Hundred and Eighth St.*, s s, 328′ w Ninth Ave., two-st'y brick stable, flat tin roof; cost, $12,000; owners, Bernheimer & Schmid, cor. One Hundred and Seventh and Ninth Ave.; architects, Sederle & Co., 196 Broadway.

Stores.

MINNEAPOLIS, MINN. — J. Booth, three-st'y brick store and flat, 404-6 Plymouth Ave.; cost, $12,000.

Wm. Blakeman, two-st'y brick store and flat, 405-407 Plymouth Ave.; cost, $5,000.

S. W. Ryan, three-st'y veneer store and flat, 1512 Crystal Lake Ave.; cost, $3,500.

Weber Bros., two-st'y double wood dwell., 607 Marshall St., n e; cost, $3,500.

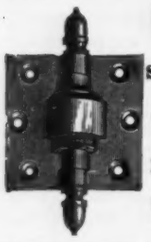
NEW YORK, N. Y. — *One Hundred and Twenty-fifth St.*, s s, 355′ e Third Ave., two-st'y brick store and office, flat gravel roof; cost, $5,000; owner, Bart Walther, 241 East One Hundred and Twenty-third St.

West Twenty-fourth St., Nos. 109 *and* 111, two-st'y brick show-room, flat tin roof; cost, $4,000; owner, James Barber, Englewood, N. J.; architect, James Stroud, 1267 Barclay St.

PROVIDENCE, R. I.—Frame store and dwell., s w cor. Arthur and Atwell Aves.; cost, $5,800; owner, G. A. Schultz; architect, S. B. Hopkins; builder, W. A. Childs.

SPRINGFIELD, MASS. — Day, Johnson & Co., intend at some time, probably in the summer and possibly later, to build a first-class, four-st'y brick block on their large lot cor. North Main and Sargeant Sts., directly opposite the street railroad barn.

Hardware.



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SIMPLE, EASILY SET,

Cannot be Put on Wrong.

They work either way, right or left. All sizes. Single or double acting.

For Wire Screens or Light Doors they have no equal.

Send for Price List.

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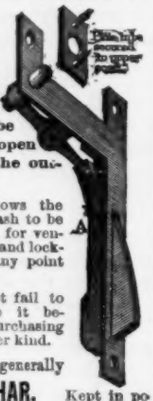
Farquhar's Improved

BURGLAR PROOF

Sash Lock.

This new device is a perfectly secure lock for the window which cannot possibly be forced open from the outside.

Lock applied.



It allows the upper sash to be dropped for ventilation and locked at any point desired.

Do not fail to examine it before purchasing any other kind.

Kept in position by spring A.

For Sale by Hardware Dealers generally

CHANDLER & FARQUHAR,

Manufacturing Agents,

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WHITE'S FLEXIBLE METALLIC FILLET,

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PITTSBURGH, PA.

Plain and Artistic Grates.

PEERLESS

Shaking and Dumping Grates a *Specialty*. All shapes of Frames. Electro Bronze, Brass and Black. *Send for Catalogue and other information.*

In writing please mention this Paper.

BUILDING INTELLIGENCE.

WATERVILLE, ME. — Messrs. Webb & Webb have had the plans prepared for a business block, which they propose to erect this season. The material to be used will be of stone. The building will be three-st'y, devoted to stores, offices, and a hall for society purposes.

Tenement-Houses.

NEW YORK, N. Y. — On the cor. Hudson and Beach Sts., an improved tenement-house with stores below, 27′ x 130′ 6″, is to be built for the H. Carey Estate, from plans of Messrs Kimball & Ihnen.

On n w cor. Second Ave. and One Hundred and Second St., 7 five-st'y tenements with stores, 25′ fronts are to be built at a cost of $85,000 by Mr. Jas. C. Ferriber, from plans of Mr. John Brandt.

At Nos. 168-174 Ludlow St., 3 five-st'y brick and stone tenements with stores, are to be built at a cost not yet estimated, by Mr. Geo. B. Christman, from plans of Mr. Wm. Graul.

East Twenty-fourth St., No. 228, five-st'y brick tenement, flat tin roof; cost, $12,000; owners, Soun Bros., 367 Washington St.; architect, M. C. Merritt, 1267 Broadway.

West Thirty-eighth St., No. 407, three-st'y brick tenement, flat tin roof; cost, $9,000; owner, Henry C. Cook, 511 Ninth Ave.; architects, Thom & Wilson, 1267 Broadway.

Ninth Ave., w s, 125′ n Ninety-eighth St., 2 five-st'y brick tenements, flat tin roofs; cost, $44,000; owner, John W. Haaren, 338 Greenwich St.; architect, John C. Burne, 1531 Third Ave.

Ninety-eighth St., n s, 75′ w Ninth Ave., *Ninety-Ninth St.*, s s, 75′ w Ninth Ave., 2 five-st'y tenements, tin roofs; cost, $49,000; owner, John W. Haaren, 338 Greenwich St.; architect, John C. Burne, 1531 Third Ave.

Allen St., No. 115, five-st'y brick tenement, flat tin roof; cost, $12,000; owner, Jacob Valentine, 124 East Fifty-seventh St.; architects, Julius Boekell & Son, 54 Bond St.

Eighth Ave., w s, 24′ 11″ n One Hundred and Twenty-ninth St., 3 five-st'y brick tenements, flat tin roofs; cost, $45,000; owner, Henry Gerken, 1454 Third Ave.; architect, John Brandt, 1491 Third Ave.

East Broadway, No. 29, five-st'y brick tenement, flat tin roof; cost, $15,000; owner, Morris Alexander, 97 East Broadway; architect, Frederick Ebeling, 140 Second Ave.

West Fifty-second St., No. 360, five-st'y brick tenement, flat tin roof; cost, $9,000; owner, Mrs. Ann Dick, 554 West Forty-eighth St.; architect, F. W. Klemt, 209 East Seventy-fourth St.

Fifty-fourth St., s s, 80′ e Ave. A., *Fifty-fourth St.*, n s, 80′ e Avenue A, five-st'y brick tenements, flat tin roof; cost, $84,000; owner, Owen Donahue, 453 West Sixty-third St.; architect, D. J. Atwood, 335 Broadway.

East Sixteenth St., No. 533, four-st'y brick tenement, flat tin roof; cost, $6,000; owner, Patrick Kelley, 522 East Sixteenth St.; architect, Fred. Jenth, 191 Forsyth St.

Eighth Ave., w s, 24′ 11″ n One Hundred and Twenty-ninth St., 3 five-st'y brick tenements, flat tin roofs; cost, $45,000; owner, Henry Gerken, 1454 Third Ave.; architect, John Brand, 1491 Third Ave.

Warehouses.

BROOKLYN, N. Y. — *Baltic St.*, river-front, 2 six-st'y brick warehouses, gravel roof; cost, about $65,000; owner, Jeremiah P. Robinson, 6 Montague Terrace.

Lee Ave., n e cor. Middleton St., four-st'y brick storehouse, tin roof; cost, $8,000; owner and contractor, Jacob Bossert, 229 Heyward St.; architects, Platte & Acker; builders, J. Auer and J. Bossert.

Atlantic and Pacific Sts., foot of, Columbia Stores, one-st'y frame storage-shed, gravel roof; cost, $8,000; owner, David Dows, No. 1 East Sixty-ninth St., New York; contractor, John H. Euler.

Miscellaneous.

FORT WAYNE, IND. — The Fort Wayne Lodge of I. O. O. F., has purchased corner property for $21,000. A fine edifice will probably be built this summer.

MCPHERSON, KANS. — J. G. Haskell, Esq., of Topeka, architect, is making arrangements for the building of the new Masonic Hall.

Bids and Contracts.

MONSON, MASS. — The Flynt Building and Construction Company of Palmer have taken the contract to build Cushman's new woollen mill.

PHILADELPHIA, PA. — Contracts for furnishing the Philadelphia Commissioners of Public Works with certain materials have been awarded to the lowest bidders, as follows: —

For bricks required during the year, Amos Dotterer, at $7.20 per 1,000; for wrought-iron clamps, L. Syke & Son, at 4 8-10 cents per pound; for rolled-iron girders and beams for floors of clock tower,

"Giant Metal Sash Chain."

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The most reliable and economical article in the market for the purpose. GREAT TENSILE STRENGTH Does not corrode; does not lose its vitality by continuous use, or exposure to the elements; runs over any pulley, and gives satisfaction wherever it is used. Fixtures made of steel wire, is very simple and easily applied. Prices very low. Samples sent to any architect in the United States, free, on application. Now in use n State House, Hartford; Providence City Hall; Singer Building, Chicago; J. C. Flood's, Menlo Park, Cal.; Vanderbilt and Florence Flats, New York; Boreel Building, New York; new State War and Navy Departments, and Patent Office, Washington, D. C.; *Herald* Building, Boston, and very many other fine buildings in all parts of the United States.

The "CLIMAX" Rail for all Sliding Doors.

Fig. 1. showing the door open, with centre rail level with floor. Fig. 2. Section of sheave, showing its position on rail. Fig. 3. Showing the door closed, with sheave in position and centre rail depressed. Fig. 4. Showing the track running off in the recess.

We claim for this rail all of the following advantages:

It is level with the floor, offering no obstruction in walking, dancing, moving of furniture, etc.

The door cannot get off the track, and runs lightly, smoothly, and noiselessly.

The house does not have to be built for the track, it can be laid in old houses as well as in new.

Full directions for laying them sent with each Track.

Models sent on application.

Manufactured only by the "CLIMAX" Rail Co.

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Address all Communications to **GEO. F. TAYLOR, Business Manager, 134 Water St., New York.**

THE BURROWES PATENT, SLIDING,

Wire Window Screens,

And Improved Screen Doors,

Are in use in thousands of houses in all parts of the United States, particularly in larger cities and towns.

The Window Screens may be used inside or outside, slide to upper or lower sash, are held in place by steel springs, and may be instantly removed by pressing to one side.

We make twelve times as many screens as any other concern in the country, and the only screens suitable for a good house. Prices are very reasonable, we pay the freight.

Send for Circular, Price-List and Pamphlet. Pamphlet contains testimonials from prominent architects and citizens from nearly every state, and cuts of twenty modern dwellings. Free by mail. Address

E. T. BURROWES & CO., - Portland, Maine.

10

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The most **RELIABLE** and **CHEAPEST** article in the market for suspending

Window-Sashes.

HAS GREAT TENSILE STRENGTH,

Can be easily applied to any window, and gives SATISFACTION wherever used.

Samples sent to any ARCHITECT free on application. Now in use in all the leading cities throughout the United States.

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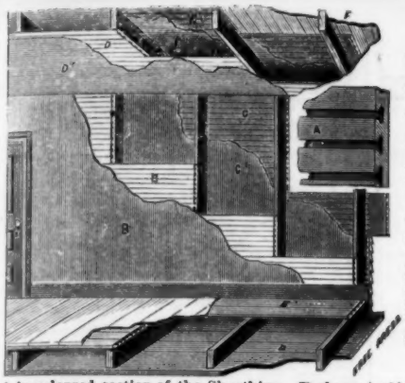
FOR A SASH OF 250 LBS.



A is enlarged section of the Sheathing. B shows inside application to receive Plastering B. C is outside application for back-plastering C. D is application to receive plastering for Ceilings. E is EUREKA, used for Floor Linings for deadening Plaster.

EUREKA SHEATHING.

EUREKA SHEATHING has undercut grooves on one side, and is tongued and grooved, and may be plastered on one side.

EUREKA LATHING has undercut grooves on both sides of the sheathing, and may be plastered on both sides.

EUREKA SIDING is any form of German siding, with undercut grooves on the back, to receive a coat of back-plaster, to make a wall tight and warm.

The attention of ARCHITECTS and others interested in building, is especially called to the value of EUREKA LUMBER, for the following uses, viz.:

As an *Outside Sheathing* to receive rough Cast and Stucco on outside walls also to receive back plastering between the studding. On *Frame Hotels* and all *Frame* buildings of the better sort, its use in this way is very desirable, rendering them warm in winter and cool in summer.

As a Floor-Lining for deadening and fire-proofing floors.

As a Roofing on *flat, steep* and *French Roofs*, plastering the under side, between the rafters, and covering with *Slate, Tin* or *Gravel*, making a practically *Fire-Proof Roof*.

As a substitute for *Lathing* on interior walls or ceilings. Owing to the peculiar construction of EUREKA LUMBER, plastering applied to it is much less liable to crack than on ordinary lathing. As all *Balloon Frame* buildings are sheathed, they are already lathed when the EUREKA LATHING is applied, thus saving the cost of lathing.

EUREKA LUMBER is made any width, and with ease and rapidity, on any ordinary planer. No SAWS to keep in order.

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Eureka Sheathing!
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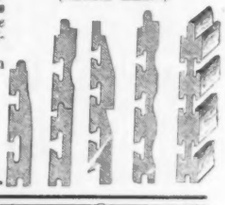
(TRADE MARK)



CITY ENGINEER'S OFFICE, CITY HALL,

PROVIDENCE, R. I., March 12, 1886.

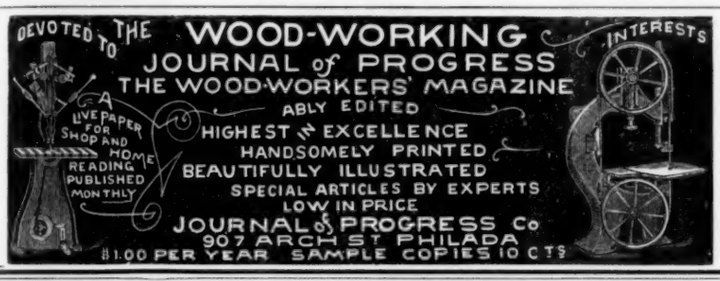
Abstract from letter of

SAMUEL M. GRAY, CITY ENGINEER.

During the season of 1885 the **Sewer Department** used **3,152 Barrels** of the **New York and Rosendale Cement.** Of this amount **1,348** barrels were tested for tensile strength, the average of the Season's tests being **165.7** pounds per square inch, twenty-four hours test.

One hundred and forty-five barrels were tested for fineness, the average amount passing through a **2,500** mesh sieve being **92.56** per cent.

Tests for checking were occasionally made but none were discovered.



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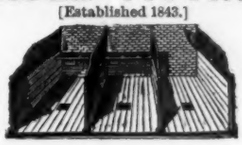

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Amateur Conservatory, 8 feet by 12 feet, with patent heating apparatus, plant stages etc., complete for $150. F. O. B.

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BUILDING INTELLIGENCE.

Phœnix Iron Co., of Trenton, at $3,887.50; for materials for roof of boiler room, Manly & Cooper Manufacturing Co., at $9,343; for granite curbing for pavilions, Mt. Waldo Granite Co., at $1,747. The contract for furnishing cement for the year was awarded to C. Rex Allen, the only bidder, at $2.92 per barrel of Portland cement (400 pounds) and $1.13 per barrel of Rosendale cement (300 pounds).

COMPETITION.

KANSAS CITY EXCHANGE.
[At Kansas City, Mo.]

KANSAS CITY, MO., March 31, 1886.

The Exchange Building Association of Kansas City are proposing to erect a building to cost not more than $400,000 dollars. They have specially invited several architects to furnish designs in competition, but will also receive and consider designs by other architects not so invited. The drawings are to be in line, and are to be made to a scale of one-sixteenth of an inch to the foot, and are to be delivered **on or before the 15th of June next,** at Columbia College in the city of New York, to the care of PROF. WILLIAM R. WARE, whom the Association have appointed to be their professional adviser.

Printed instructions will be furnished on application to the editors of the *American Architect and Building News*, or to the undersigned.

EDWARD H. ALLEN,
President of the Exchange Building Association.
539

CHANGE OF TIME.

DEPARTMENT OF PUBLIC WORKS,
OTTAWA, March 12, 1886.

The time for seeing the plans and specifications for the Infantry School at London, Ontario, is hereby changed to **Tuesday, the 23d inst.**, and the time for receiving tenders to **Wednesday, April 7.**

By order, A. GOBEIL,
Secretary.

PROPOSALS.

METAL WORK FOR LIGHT-HOUSES.
[At Delaware Bay, Del.]

OFFICE OF LIGHT-HOUSE ENGINEER,
FOURTH DISTRICT,
PHILADELPHIA, PA., April 1, 1886.

Sealed proposals will be received at this office until 2 o'clock, P. M., **of Tuesday, the 20th day of April, 1886,** for furnishing the materials and labor of all kinds necessary for the construction, delivery and erection on the site of the metal-work of the superstructure for the fourteen-foot bank light-house, Delaware Bay.

Plans, specifications, forms of proposal and other information, may be obtained on application to this office. The right is reserved to reject any or all bids, and to waive any defects.

JOHN C. MALLORY, Capt. of Engineers,
537 U. S. Army, Light-House Engineer.

MASONRY.
[At Hyde Park, Mass.]

SUPERINTENDENT'S OFFICE,
BOSTON & PROVIDENCE R. R. CORPORATION,
BOSTON, March 26, 1886.

Proposals will be received by the undersigned **until April 15th, 1886,** for building about 1450 cubic yards of masonry for abutments, piers and retaining walls for a bridge over the Boston & Providence Railroad at West Street in Hyde Park. Plans and specifications may be seen at this office.

The right to reject any and all bids is reserved.

536* A. A. FOLSOM, Superintendent.

REPAIRS, NAVAL HOSPITAL.
[At Chelsea, Mass.]

NAVY DEPARTMENT,
BUREAU OF MEDICINE AND SURGERY,
WASHINGTON, March 24, 1886.

Sealed proposals endorsed "Proposals for Repairs at Naval Hospital, Chelsea," will be received at the Bureau of Medicine and Surgery, Navy Department, Washington, **until Saturday, April 24, 1886, at 11** A. M., when they will be publicly opened, for making repairs at Naval Hospital, Chelsea, Mass.

Blank proposals, with specifications and all necessary information, can be had on application to the medical officer in charge of the hospital.

The award will be made by classes.

The right is reserved to reject any or all bids.

538* F. M. GUNNELL, Chief of Bureau.

PROPOSALS.

COURT-HOUSE.
[At York, Neb.]

Sealed proposals for the construction of a court-house in the public square, York, York County, Neb., the cost of which is not to exceed the sum of $50,000, will be received at the County Clerk's office, **on or before April 20, 1886, at 1 o'clock,** P. M. Said court-house to be built according to plans and specifications on file in the County Clerk's office, York County, or at the office of O. H. Placy, 131 South Eleventh St., Lincoln, Neb., on and after March 24 1886. The party to whom the contract may be awarded will be required to give bond in double the amount of the contract price, conditioned for the faithful performance of his obligation, said bond to be approved by the County Board.

The Board reserves the right to reject any or all bids. By order of the Board.

538 M. SOVEREIGN, County Clerk.

ELECTRIC-LIGHTING.
[At Holyoke, Mass.]

HOLYOKE, March 18, 1886.

Bids for lighting the streets by electricity, will be received by the undersigned **until April 6 next, at 5 o'clock,** P. M. Bids must be sealed and indorsed, "Proposals for Electric-Lighting."

The committee reserve the right to reject any or all bids.

Per order Committee on Fuel and Street Lights.

536 R. P. DONOGHUE, Chairman.

Iron-Work.

MESKER & BRO.,

Galvanized Iron Cornices

Window Caps and SKYLIGHTS.

Send for Catalogue.

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INTERIOR CREOSOTE STAINS

DO NOT SMELL—FADE—OR RAISE THE GRAIN.

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SPECIFY INTERIOR OR EXTERIOR.

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Architectural Iron-Work,

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Railings, Fountains, Stairs, Doors, Stable-Fittings, Crestings, Shutters, Tree-Guards, Settees, etc.

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PROPOSALS.

CONCRETE BLOCK. [At Sandy Bay, Mass.]

U. S. Engineer, Office, 33 Pemberton Sq., Boston, Mass., March 8, 1886.

Sealed proposals in triplicate, will be received at this office **until 12 o'clock, noon, Thursday, April 15, 1886,** for the manufacture of a concrete block, weighing 168 tons approximately, and for its transportation to, and establishment upon Avery's Ledge, Sandy Bay, Mass.

For specifications and blank forms apply to the undersigned. G. L. GILLESPIE,

*537 Major of Engineers, Bvt. Lt.-Col., U. S. A.

SHEET COPPER, RIVETS, ETC. [At Washington, D. C.]

Office of Building for State War and Navy Departments, Washington, D. C., March 23, 1886.

Sealed proposals for furnishing and delivering under one contract the tinned sheet copper, rivets, galvanized iron fastenings, etc., required for the roof of the west and centre wings of the Building for State, War and Navy Departments in this city, will be received at this office **until 12 M., on Thursday, the 15th day of April, 1886,** and opened immediately thereafter in presence of bidders.

Specifications, general instructions to bidders, and blank forms of proposal will be furnished to regular manufacturers or dealers on application to this office.

THOS. LINCOLN CASEY,

536 Col. Corps of Engineers.

BRIDGE. [Over Harlem River, N. Y.]

Sealed proposals will be received by the Harlem River Bridge Commissioners, at their office, Room 73, Cotton Exchange Building, Hanover Square, New York City, **until 12 M., on the 22d of April next,** for the construction of the proposed bridge over the Harlem River at One Hundred and Eighty-first St.

Plans, specifications and forms of proposal can be had at the Commissioners' office on and after Monday, March 22.

For full information see *City Record*, for sale at No. 2 City-Hall. 539

SEWERS. [At Buffalo, N. Y.]

Sealed proposals will be received at the office of the Board of Sewer Commissioners, 44 Chapin Block, Buffalo, N. Y., for executing the work hereunder mentioned, the same being the construction of the Genesee Street Branch of the Buffalo Trunk Sewer, until 3 o'clock, P. M., on **Tuesday, April 6, 1886,** and opened immediately thereafter.

The work to be done is the construction of a trunk sewer in Genesee St., from the Erie Canal to Herman St. and all its appurtenances as indicated by the plans and specifications.

Total length of sewer about 11,950'.

The diameter ranging from 4' to 7'.

The estimated quantity of brick to be laid is about 4,500,000.

The plans and specifications for the work may be seen at the office above stated.

Dated 16th day or March, 1886.

The Board of Sewer Commissioners of the City of Buffalo, N. Y. D. C. BEARD, Chairman.

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HOUSE OF CORRECTION AND STATE PRISON. [At Marquette, Mich.]

Office of Commissioners State House of Correction and Prison, Upper Peninsula, Michigan, Marquette, Mich., February 27, 1885.

Sealed proposals for the furnishing of materials and construction of the State House of Correction and branch of the State Prison in the Upper Peninsula, Michigan, at Marquette, Mich., under the acts of the Legislature, No. 149, Public Acts of 1885.

Sealed proposals are invited by the Board of Commissioners appointed under said act 148, **until Wednesday, April 28, at 5 o'clock,** P. M.

Plans, specifications and instructions to bidders may be seen on and after the 15th day of March, 1886, at the office of the Board of Commissioners at Marquette, Mich, and at the office of the architects, Wm. Scott & Co., Nos. 4 and 5, Wayne County Savings Bank Building, Detroit, Mich.

Proposals must be submitted for the entire work, and the Board of Commissioners reserve the right to accept such proposals as they may deem for the best interests of the State or reject all.

Proposals are required to be submitted on the schedule blanks and accompanied by a copy of instructions to bidders, both of which, with copies of the act will be furnished to intending bidders upon application to the Secretary of the Board.

All bidders will be required to furnish bond and security or a certified check, payable to the order of the Board of Commissioners equal in amount to two-and-one-half per cent of the bid submitted, which bond or certified check will be forfeited to the Board of Commissioners in the event of the failure or refusal of the bidder to enter into contract with the Board should the bid be accepted. All proposals must be sealed and indorsed "Proposals for State House of Correction and branch of State Prison, Upper Peninsula, and addressed to the Board of Commissioners at Marquette." For further information apply to the Secretary of the Board at Marquette, Mich.

E. P. ROYCE,

President of Board of Commissioners for State House of Correction Prison, Upper Peninsula.

Attest: Geo. P. Cummings, Secretary.

PROPOSALS.

PAINTS, OILS, BRUSHES, ETC. [At Annapolis, Md.]

Pay Office U. S. Naval Academy, Annapolis, Md., February 25, 1886.

Sealed proposals will be received **until Monday, April 5, at noon,** for the following supplies, to be delivered at the Naval Academy, Annapolis, Md., or on board the Academy steamer at Baltimore, Md.

PAINTS, OILS, BRUSHES, ETC.

Detailed lists of articles required will be furnished to persons desiring to bid upon application to this office.

Proposals will be received only from regular dealers or manufacturers, must be in duplicate, and entitled "Proposals for Paints, Oils, etc."

A written guarantee, as prescribed in Section 3719, Revised Statutes, must accompany each proposal.

The right is reserved to reject any or all bids.

536 FRANK H. ARMS, Paymaster U. S. Navy.

JETTIES, [At Cape Charles, Va.]

Office of the Light-House Engineer, Fifth District, Baltimore, Md., March 10, 1886.

Sealed proposals will be received at this office **until 12 o'clock, M., of Saturday, April 3, 1886,** for furnishing the material and labor of all kinds necessary for building a jetty and wall of logs and stone, or of brush and stone at Cape Charles Light Station, Va. Amount available, about $14,000. Specifications, forms of proposals and other information may be obtained on application to this office, where maps of the locality may be seen. The right is reserved to reject any or all bids, and to waive any defects.

JAMES F. GREGORY,
Captain of Engineers, U. S. Army,
Light-House Engineer, Fifth District.

COURT-HOUSE. [At Davenport, Iowa.]

Office of the Auditor of Scott Co., Iowa, Davenport, Iowa, March 1, 1886.

Sealed proposals for the erection of a court-house for Scott County, Iowa, at Davenport, will be received at the Auditor's office **until 2 o'clock,** P. M., **April 8, 1886.**

Plans and specifications can be seen at the Auditor's office in Davenport, or at the office of J. C. Cochrane, Architect, 78 Ashland Block, Chicago, after the 10th day of March.

The Auditor or architect will furnish bidders with printed slips giving full instructions, upon application.

[Signed]

I. H. SEARS,
HENRY RUWE,
W. B. MURRY,
L. ROGGE,
U. M. KELSEY,
} Board of Supervisors.

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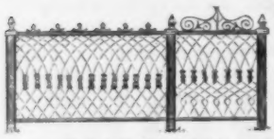

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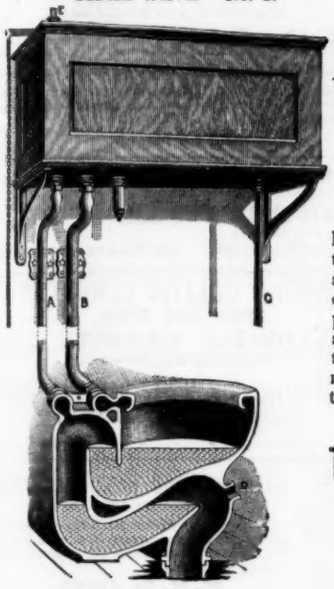

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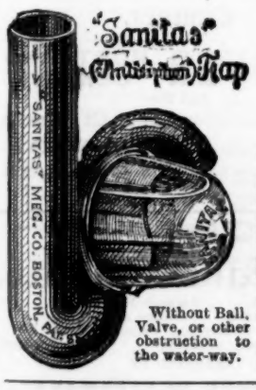

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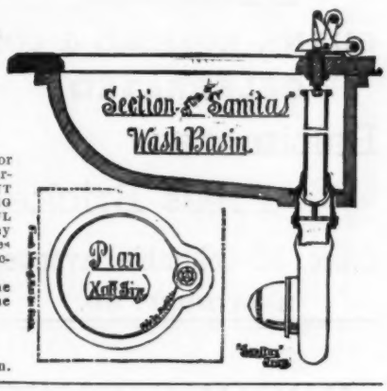

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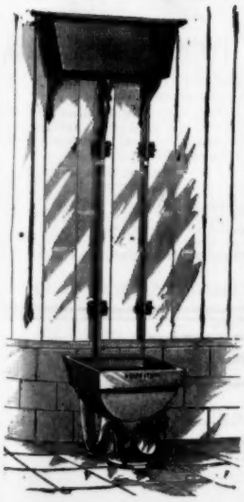

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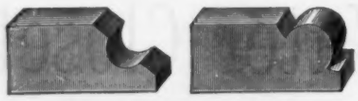

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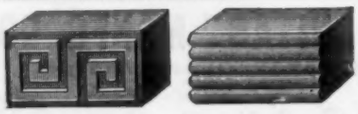

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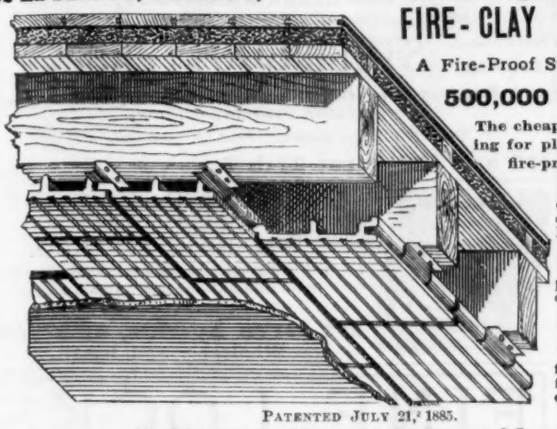

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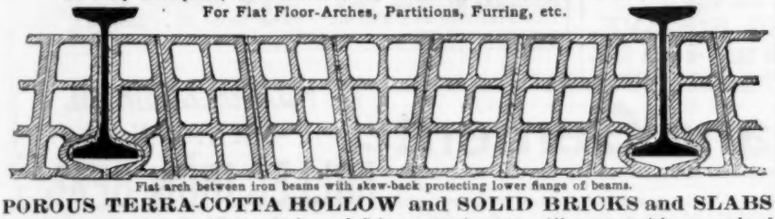

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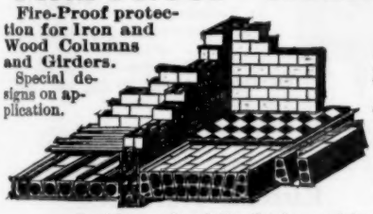

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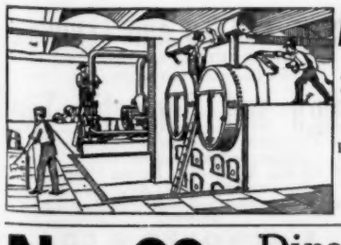

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GUARANTEED ROOFING-TIN SOLD AT ITS REAL VALUE.

For the past ten years, owing to keen competition among manufacturers and dealers, coupled with decline in values in nearly all classes of material, the quality of the current brands of roofing-tin had been gradually growing poorer and poorer. Many of the old brands that could at one time be relied upon have latterly caused frequent complaints on account of their inferiority as compared with their former standard. This has, in a great measure, been caused by the *abuse* of the patent-rolled system, by which the metal was squeezed off by passing through rolls that revolved in the top of the melting pot, and through which the sheet must necessarily pass in being coated. By this method a fine *appearance* was obtained in many instances, but as far as *durability* was concerned, it was a lamentable failure.

Alive to the importance of a radical change in the entire system, Messrs. N. & G. Taylor Co., Tin Plate and Metal Dealers, of Philadelphia, who have been closely identified with the trade for the past seventy-five years, conceived the bold idea of re-establishing upon the market the old-fashioned *dipped* roofing-tin—same kind as had been used by our ancestors in the good old times "before the War," so to speak.

To this end, they immediately made arrangements with the Copper Miners' Tin-Plate Co., of Taibach, Glamoganshire, Wales — one of the oldest works in existence — to make a brand of double-coated roofing-tin for them, which they branded "Old Style." This was afterwards called the "*Genuine* Old Style" brand double-dipped roofing-tin, and in order to protect dealers, the brand was registered in the English courts with a trade-mark the device a target and arrow.

The news of a redipped guaranteed roofing-plate upon the market swept over the country like wild-fire, and in the short space of a few months caused *a complete revolution in the history of the trade*, affording food for thought for many of the trade papers and innumerable circulars. A demand suddenly sprang up for better brands and a better quality of roofing-tin. Architects and roofers, alive to their interests, demanded that something further should be done in the matter of protection, so that the brand they had contracted for and specified, *could be detected after the job was complete*. To meet this demand, and to distinguish their brand above all others, Messrs. N. & G. Taylor Co. immediately conceived the idea of having stamped neatly in one corner of each sheet the words "old style," registered trade-mark of target and arrow, and their name. This indentation is small and but slight, and in no way injures the metal, and can thus be easily detected after the tin is laid upon the roof and painted.

Messrs. N. & G. Taylor Co. announce in their circular that they guarantee the "Old Style" brand to be absolutely perfect in every respect, without the slightest imperfection, made from refined materials, and coated continuously and separately with successive coatings and immersions by the old-fashioned hand-dipping process, so that the plate will absorb all the coating that it can possibly retain. *They also guarantee it to be the heaviest coated plate made.*

There are many imitations of this fine plate, but they can be easily detected when placed alongside of a sheet of the "Genuine Old Style." Some of the imitations are making preposterous overtures to win favor and push their sale, but the fact remains that nothing can be made that can approach the "Genuine Old Style" in quality, durability, and heaviness of coating.

This stamping of each sheet, as originated by Messrs. N. & G. Taylor Co. will undoubtedly prove of lasting benefit to the trade. They believe that it will eventually lead to the stamping of many of the prominent brands of roofing-tin, and bring about, in the near future, a fairer competition to all concerned.

Further than this, roofers can put in their bids with the security that all will now be on an equality. If the "Old Style" brand is specified, it will have to be used. *Deception will be impossible*, as no inferior imitations with similar sounding names, or sheets, having the *outward appearance* of the "Genuine Old Style" brand can be pushed in place of the brand specified. One of the strongest points in favor of the "Old Style" brand is that Messrs. N. & G. Taylor Co. have never received a single complaint of its quality. This cannot be said of any other brand.

Messrs. N. & G. Taylor Co. further say that they are not only willing to furnish any guarantee that ever has been or can be made of a sheet of roofing-tin, but will further guarantee the "Old Style" brand to stand all the different tests and work necessary for laying a roof. They guarantee it not to break, or show any imperfections whatsoever; in other words, to be absolutely perfect; and handling the plate, as they have been for many years, and knowing it as they do, are fully prepared to carry out this assertion in every respect.

THE RAYMOND SECTIONAL HEATING BOILER.

The Raymond Furnace and Manufacturing Company, 76 Beekman Street, New York, have recently brought out a new cast-iron sectional boiler and heater. By the addition of sections the boiler can be built up to any desired size, varying from a boiler suitable for a small house to one having the necessary heating power for a large building. The sections are separately bolted together by means of inside projecting lugs, and at the bottom the water-legs are fastened together by brass right and left water-connections. A special feature of this boiler is that it has a continuous steam-space and also a continuous water-space except in the water-legs. The latter, however, as mentioned above, are connected at the bottom so that there is always a free circulation of water between them. The boiler has two rows of horizontal flues. The heated products of combustion from the coal are drawn to the back of the furnace, and from there are deflected through the lower rows of flues; from the front of the boiler they are again deflected back through the upper row, and thence pass to the chimney. The horizontal flues are a feature to which the manufacturers particularly direct attention, as by this construction the flues can be cleaned without having to put out the fire. Besides the longitudinal horizontal flues there are also two rows of cross flues between each section which serve to increase the heating surface of the boiler. The boiler is set in brickwork, and, where so desired, hot-air connections may be made with the space between the boiler and the setting, so that the heat of the water may be utilized for indirect heating. This arrangement is said to have given great satisfaction where used, as rooms may be heated even when there is no positive steam pressure. The right and left water connections at the bottom of the water-legs, being of brass, do not rust, so that the boiler may be taken apart, if necessary, without danger of breaking the sections. Rocking grate-bars are employed, and the boiler is fitted with all the usual automatic arrangements, a full set of wrought-iron fire tools being also furnished in each case.

RAYMOND FURNACE & M'F'G CO.
76 BEEKMAN STREET, NEW YORK.

ROCK ASPHALT.

From a paper read by Professor T. M. Clark before the Society of Arts, Boston, Mass., on Fire-proof Building in New York, we quote:—

"In describing a floor of a New York fire-

proof building we describe also the roof, which is made in exactly the same way as a floor, with iron beams, filled-in and protected by hollow terra-cotta blocks, which are then levelled up with concrete, and the whole then covered nearly or quite an inch thick with rock asphalt, precisely like that used for paving the streets of Paris, and put on in the same way. Once put down on a sufficiently rigid framework of beams, such a roof is as permanent as the building itself. The heat of the sun does not affect it, water runs off it as from a granite slab, and the movement upon it, even of horses and carriages, would deteriorate it very slowly, if at all. It is difficult to see where the deterioration of a structure like this could begin. Centuries must elapse before the asphalt-roof covering would decay far enough to admit water to the interior."

Seyssel Rock-Asphalt is a limestone impregnated with about ten per cent of bitumen, and is obtained from the quarries at Pyrimont-Seyssel, Department of the Ain, France. It is a tough, chocolate-colored stone, of nearly the same specific gravity as a well-burned brick. Though not malleable when cold, it becomes so if sufficiently warmed, while a higher heat (140°) reduces it to powder.

The origin of bitumen, the generic name of several hydrocarbons, but slightly oxygenated, varying in consistency from a fluid to a compact tough solid, with changes in the proportions of the constituent elements, is rather conjectural; it is not yet fully understood. Its elements — carbon, hydrogen and oxygen — indicate its derivation from organic substances buried in the earth's crust through changes effected by decomposition and recondensation under varying conditions of temperature. It is found in the vicinity of extinct and existing volcanic action, and it has, also, in limited districts, permeated sand-grits and argillaceous and calcareous rocks of the secondary geological formation. By boiling the sand-grits, mineral tar or bitumen can be obtained, which is used to convert the asphalt rock into a mastic. The mastic is made into blocks of a size that can be readily handled, and they bear the trade-mark of the manufacturers to prevent deception. When wanted for use the blocks are broken, and after having been properly heated, about fifty per cent of fine, clean grit is added, with from five to ten per cent of bitumen, according to the degree of hardness required of the finished work. It is spread, while hot, in one or two layers, and as soon as it has cooled it is ready for use, presenting a durable, even surface, water-tight and fire-proof.

Being absolutely impervious to moisture, it is largely used for sanitary purposes, and for stables, laundries, brewery and cellar-floors. It is strictly non-combustible, and for that reason admirably suitable for roofs and for floors of buildings required to be fire-proof. In this connection it might be observed that all the floors of the new Church-Street building of the American Bank-Note Company, in New York, are of this rock asphalt, on which is placed their heavy machinery.

The sidewalks, roofs, etc., of Seyssel rock asphalt in Paris are so well known that no allusion is necessary here. In New York a great deal has been already done in this way, notably Union Square, and a fine piece of work on the western side of Fifth Avenue, from Sixtieth to Eighty-Fifth Street. Other asphalts have been used here with more or less success, but as a general rule they have not proved to be so durable. M. Léon and Malo other eminent French engineers have always given the preference to Seyssel, which obtained, for 'superiority over all other asphalts,' the only gold medal at the Paris Exhibition of 1878. The Compagnie Générale des Mines d'Asphalte, owners of these extensive mines since 1794, have appointed me their sole agent in the United States and Canada. I also import Bitumen Damp-Course, Portland Cement, and other building materials of foreign manufacture.

E. H. Wootton, 29 Waverley Place, New York.

A NEW TILE FOR FLOORS.

A new tile has just been placed upon the market which promises to be very popular. The demand is daily increasing, and the Mosaic Tile Company, the manufacturers, have certainly a fine business in prospect. This tile, manufactured under special patents, is made out of hydraulic lime compressed by pressure. Any pattern or color may, in fact, be made in the most substantial, durable way. Like Roman cement of yore, it defies age, getting harder and harder with time. It acquires a fine polish with use, and, instead of wearing out like marble, it has the further advantage of not staining, and of being easily and firmly laid. Last, but not least, its price is quite reasonable. The works are at Brooklyn, L. I., the office No. 15 Platt Street, New York. Samples can be seen and information obtained at No. 56 Worth Street, Room 53. The company have a large and well-assorted stock of plain and figured tiles for floors in halls, churches, hotels, banks, public buildings, private residences, etc. — *From the Record and Guide, January* 30, 1886.

AN IMPORTANT DECISION.

The long-delayed suit of the New York Belting and Packing Company *versus* Allan Magowan for an infringement of their well-known vulcanized rubber-back packing, has been recently decided in favor of the company. In his decision, after some pertinent compliments to the ingenuity of the inventors. Judge Dixon declared that "after carefully comparing it with the exhibits which are put in to show anticipation and its lack of patent, ability, I am of the opinion that the patent reveals invention; not so much because the packing is more elastic by reason of the addition of pure rubber, but because the patent discloses a new and better method of obtaining a tight joint between the padding and the piston-rod than has been obtained by any other combination of elements, new or old. It is a fact not to be overlooked, and has much weight, that the products manufactured under it went at once into such extensive public use as to almost supersede all packing made under other methods. Such a fact is pregnant evidence of its novelty, value, and usefulness, and accounts for the defendants' infringement." It is hardly necessary to say that the New York Belting and Packing Company are as widely as favorably known for their superior vulcanized rubber goods for mechanical purposes.

N. Y. Belting and Packing Company, 13 and 15 Park Row, New York.

"OTTO" GAS-ENGINE.

The makers of the Clerk Gas Engine in England submit to a perpetual injunction.

The case of Otto *vs.* Sterne (L. Sterne & Co.), which it was understood was settled previous to the trial of the action of Otto *vs.* Steel, was called up on the first of February in the High Court of Justice — Chancery Division — before Mr. Justice Pearson.

The attorney for the plaintiff stated that the case had been standing out of the paper pending a settlement, and the parties had now arranged terms. The defendant had agreed to submit to a perpetual injunction, and to pay the costs; plaintiff on his part not pressing for any inquiry as to damages.

The attorney for the defendant agreed to these terms, and the order was made accordingly.

(Reported in the *Journal of Gas-lighting* (London), No. 1187, p. 254, Legal Intelligence.)

"Otto" Gas Engine Works, Schleicher, Schumm & Co., Philadelphia.

MINERAL WOOL.

There is a struggle going on under every domestic roof between the cold and the heat which, though unseen, is not without its interest to the occupant of the house. The matter of creating warmth is the only one that need be considered, for the relation of cold and heat is such that, if you provide against the severity of the former, you, at the same time, protect yourself from the intensity of the latter. There is this difference, however, in the supply of heat: there is economy to be practised, and this narrows the field of our work down to the simple question of protecting a house from the cooling effects of the weather.

A corner-room whose vertical walls are hollow, cannot be said to be comfortable when heated by a stove, for the reason that the surface of the stove has a temperature of 180°, while the interior surface of walls has a temperature of 40°. The problem before us in this case, which is the one presented to every man in building a dwelling, is, how to construct the exterior walls, so that the temperature of the interior surface shall remain at 60°, while the temperature of the exterior surface drops down to 20°. It will at once seem apparent that this is only a question of thickness of the walls. If all walls were made of one material, then this conclusion might be sound; but all the substances which, in one shape or another, might be used in the construction of the wall, have a definite value as to their capacity for conducting heat. For instance, the conducting-power of brick was determined in connection with that of various other substances, by Pèclet, to be 4.83, that is, this fraction represents the quantity of heat in units transmitted per square foot per hour by a plate one inch thick. By taking the value of mineral-wool to be .323, which is the value of sheep's wool and cotton wool (as a matter of fact it is ten per cent poorer than either of them,) we can ascertain accurately the quantity of heat which a wall of any given thickness will allow to escape. Thus a wall of brickwork four inches thick, having one surface at 60°, and the other at 20°, will transmit $4.83 \times (60 - 20) \div 4 = 48.3$ units per square foot per hour. Mineral wool, in place of the brickwork, gives $.323 \times (60 - 20) \div 4 = 3.23$ units per square foot per hour. From the result it is plain that the brickwork would have to be 40 inches thick to retain the same amount of heat that 4 inches of mineral wool does. This illustration does not exceed the limits of truth; it brings out the fact — one difficult to reconcile with our general notions in this regard — that all materials are conductors of heat, and differ from each other only in degree. Stone and marble are such high conductors that, if placed around pipes,

the loss, with all thicknesses, is greater than by an uncased-pipe, and the thicker the casing, the greater the loss. There are some concoctions that really appear to have the solidity of stone or marble, and possibly are dispensing heat out into space faster than the law requires!

The man who wishes to buy a low conductor should keep in mind the law that all good absorbents are bad conductors, and when one of the so-called non-conductors is offered him, to fill a tumbler to the brim with water, and then immerse a large piece of the material in it. If the substance under trial is a very low conductor, the water will not spill, but will be absorbed, so that a volume equal to that of the tumbler may be immersed.

Unless the low roof of a house is filled in with mineral wool, the rooms on the second floor will be insufferably hot; and while the architect is really to blame, not so particularly for sacrificing everything to looks, but for ignoring the fact that the sun's heat is certain to be transmitted, still there is no use ever expecting him to give attention to insulation, because the part of the house devoted to this object is bound to be hidden, and his profession does not thrive on the invisible. The owner is the proper one, under the circumstances, to see that the hollow walls of his balloon-frame residence are filled with some poor conductor both of heat and sound. By using mineral wool he would not only have the most efficient barrier against the passage of heat, but render the house secure against the passage of heat, but render the house secure against fire-attack, and free from the inroads of rats, mice and insects. Not only would these desirable objects be accomplished, but in a few years the expense of such a filling will be offset by the economy of heating, and reduction or absence of insurance.

U. S. MINERAL WOOL COMPANY,
NEW YORK, N. Y.

ART WORK IN GLASS.

THERE has been but little improvement in stained glass, or art work in glass, for generations. The heavy lead joints so prominent in all the fine work of the past, only detracts from the artistic effects, and even in small windows it was necessary to use iron bars to support the work. We have now a great advance to note in the new styles of stained glass, namely, the Belcher Mosaic Glass. This new glass work is being extensively used in Philadelphia, New York, Washington, and in many fine residences and prominent buildings throughout the country. The glass finishes with a smooth surface, so it can be easily cleaned; besides dust and dirt will not accumulate on it, which is a great improvement over the other method. It is put together without the use of cement, metal only being used, which is much harder than lead. It not only makes a stronger window, but one that is absolutely tight, which is unknown to any other process. As the method of joining together is such that the smallest pieces, even of an eighth of an inch, can be used, by which many fine effects can be produced that can be had in no other way. They can and do put in very large windows without using bars. One particular job of this kind is in the Union League Club House of Philadelphia, where lights thirty-nine inches by sixty inches are standing without bars. They also call attention to the disk thirty-one feet in circumference which they made for McCauls' Opera House, Philadelphia. It hangs under the chandelier in the centre of the theatre, and is very effective.

An important factor in the Metallo-Mosaic is that these beautiful effects do not cost any more than the old process work, but in all cases where the work is of a similar grade the cost is much less in these days of elaborate and rich ornamentation in both public and private buildings. Architects will find in the process what is often of paramont importance, a chance to use new and hitherto impossible effects in art-work with colored glass.

The many samples of the work of this and other cities, and the high testimonial from parties for whom work has been done, will satisfy any one seeking other information.

Our advertisement appears in another column of this paper.

BELCHER MOSAIC GLASS COMPANY,
144 SOUTH SIXTH STREET, PHILADELPHIA.

NOTES.

NEW YORK, March 1, 1886.

E. ASPINALL, late of 206 Pearl Street, begs to inform his friends and the trade that he has removed to Numbers 98 and 100 Beekman Street, and respectfully solicit their inspection of his line of sanitary goods, viz.: The "Crown" English Porcelain baths, washtubs, sinks, etc. Also, the "National," "Crown," "Unitas," and "Alliance" washout-closets, lavatory-basins and slabs, wash-basins, hoppers, urinals, etc., etc., and plumber's materials in general.

SALEM, Ohio, March 16, 1886.

IN our circular of March 6th we notified our patrons of the destruction by fire of our stamping department and warehouses. We now have the pleasure of announcing that we have made a satisfactory settlement with the Insurance Companies, and the erection of our new permanent fire-proof buildings is already in progress by which we expect to double our former capacity. In the meantime, we have made temporary arrangements, so that we can execute promptly all orders that we may be favored with; but as our manufactured stock of stamped and spun zinc architectural ornaments were all destroyed, we would again request that architects send in their orders at as early a date as possible, before they need the goods, and thus allow us all the time you possibly can to execute the same.

BAKEWELL & MULLINS,
SALEM, OHIO.

OUR FACILITIES FOR THE EXECUTION OF COMMISSIONS ARE RESPECTFULLY COMMENDED TO THE ATTENTION OF ARCHITECTS. ESTIMATES AND COMPLETE INFORMATION FURNISHED ON REQUEST.

J:& R:LAMB 59 CARMINE ST. NEW YORK

INTERIOR DECORATION

MURAL PAINTING METAL WORK
STAINED AND MOSAIC GLASS CARVED WOOD WORK

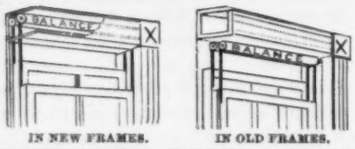
THE SKETCHES OF ARCHITECTS WILL BE CARRIED OUT IN COLOR, OR ORIGINAL DESIGNS WILL BE SUBMITTED ON APPLICATION. DESIGNS. FOR MONUMENTAL WORK MODELLED IN WAX. Correspondence Invited.

DYCKERHOFF
PORTLAND CEMENT

Is superior to any other Portland Cement made. It is very finely ground, always uniform and reliable, and of such extraordinary strength, that it will permit the addition of 25 per cent more sand, etc., than other well-known Portland Cements, and produce the most durable work. It is unalterable in volume and not liable to crack. 8,000 barrels have been used in the foundations of the Bartholdi Statue of Liberty, and it has also been used in the construction of the Washington Monument at Washington. Circular with Directions, Testimonials and Tests sent on application.

E. THIELE, 78 William St., New York,
SOLE AGENT FOR THE UNITED STATES.

ARCHITECTS, BUILDERS, CONTRACTORS
Should Investigate the Merits of
THE ORMSBY
SPRING ROLLER BALANCE.



IN NEW FRAMES. IN OLD FRAMES.

SUBSTITUTE FOR WEIGHTS and CORDS.
ORMSBY SASH HOLDER CO.,
92 Utica Street, - - BOSTON, MASS.
(Opposite B. & A. Depot.)

Band-Saw Filer.

Band-Saw Setter.

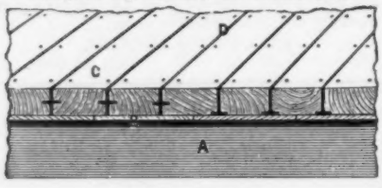
Wood-Working Machinery,
FOR PLANING-MILLS, SASH,
DOOR, AND BLIND FACTORIES,
CABINET AND CARRIAGE MAKERS.

Send for Catalogue.

Post Band-Saw.

GOODELL & WATERS,
Philadelphia, Pa.

DOLBEARE'S
Water-Tight Wood Floors.
400,000 sq. ft. now in actual use.



Patented June, 1882.

Architects, Builders, and Owners find in these an improvement long sought for. They combine lightness and durability with absolute water-tight qualities. With these floors in stables, public or private buildings, mills, ware-houses, hotels, breweries, slaughter-houses, etc., there can be no leakage of water or foul smells. They can be of any thickness desired, and will save more than their entire cost in preserving furniture, goods, and ceilings, in case of flooding of floors by fire or bursting or leaking of water-pipes. The filling is both adhesive and elastic, and allows for shrinking, expansion, and settling, etc., and brings no strain whatever on the walls, as is the case in caulking.

Good Agent wanted at the West.

OFFICE OF SAMUEL D. KELLEY, ARCHITECT.
BOSTON, Jan 21, 1885.

W. L. DOLBEARE, Esq.,

Dear Sir: — I have used your Improved Water-Tight Wood Floors, for stable purposes, for the past three years, to the extent of about forty-three thousand (43,000) square feet, and have in each case given complete satisfaction. Yours, etc., S. D. KELLEY.

VINAL'S PARK RIDING ACADEMY AND STABLES.
Cor. West Chester Park and Newbury St.
BOSTON, Dec., 1884.

Dear Sir: — The Patent Floors you put into my building eighteen months ago have proved *perfect in every respect*, one floor in particular, which has eighty stalls, with riding academy above and carriage floor below, has had a severe test, but not once have I found a leak, therefore, I can unhesitatingly recommend Dolbeare's Patent Floors.

Yours, etc., W. D. VINAL.

JOHNSON'S EXTENSION STABLES.
Cor. Curve St. and Broadway Extension.
BOSTON, Dec. 15, 1884.

W. L. DOLBEARE,

Dear Sir: — Your Water-Tight Wood Floors put in for me two years since has proved a *perfect success*. You are at liberty to refer to me at any time in regard to it. Yours respectfully, GEO. S. JOHNSON.

Orders respectfully solicited and personally attended to by addressing

W. L. DOLBEARE,
No. 522 Atlantic Avenue, Boston.

[*From the London Ironmonger, Feb.* 13, 1886.]

Stamping Waster Tin Plates,

It will be very interesting to note whether or not the tin plate manufacturers of South Wales will largely follow the example of W. Glibertson & Co., in declining to stamp waster tin plates. This company now stamp their "Old Method" plates after the tinning process has been completed, and they only stamp such plates as are critically adjudged to be "perfects." They stamp no wasters with the above brand, and announce that no wasters of their production will, with their knowledge or sanction, be sent to the United States, but will be disposed of in England under some other mark. From the first portion of this arrangement there can be no dissent, and it ought to secure for W. Glibertson & Co.'s brand a high reputation and a large sale in the United States. The wisdom of the plan thus adopted is so obvious that we might expect it to be generally adopted in the tin plate trade, yet the sinuosities and subtle intricacies of that business are so numerous and confusing that such a result is highly improbable. Deceptions and "juggles" by means of wasters are so profitable to many of the merchants and dealers that they will probably resist any such change, whilst the speculators, of course, will oppose any alteration which would be likely to simplify the business or to limit their opportunities for "hocussing" both buyers and sellers. A good example has been set in this instance, however, and we hope that some, at least, of the manufacturers will have sufficient backbone to follow suit.

ESTERBROOK'S STEEL PENS

FOR SALE BY ALL STATIONERS.
THE ESTERBROOK STEEL PEN CO.
20 John Street, New York, N. Y.

Something New for the Stable.

Read's Patent Harness Bracket.

An Article long wanted but never before made.

Holds the whole harness, takes no more room than the ordinary hook or peg, can be used for both single and double harness. Gives the harness-case a neat appearance, as it carries the harness up uniformly in width with the saddle, beside keeping the bridle and breastplate in their proper shape. They are neatly japanned, with gilt facings. Price $18 per dozen. Are now in use in over 100 first-class private stables in and about Boston.

Each bracket lettered "J. J. Read, Boston, Mass." For sale by dealers everywhere.

Indorsed and approved by the following named gentlemen, all of whom have them in use:

Boston; R. H. White, J. M. Sears, J. T. Morse, Jr., Thos. Motley. Cambridge: F. A. Kennedy. Portsmouth, N. H.: Hon. Frank Jones. Milton: H. P. Kidder, Col. H. S. Russell, J. M. Forbes. Dedham: A. W. Nickerson. Newton: J. C. Potter. Salem: Dr. W. Saunders. Waltham: J. H. Ellison. Readville: C. G. White. Beverly: Dr. Chas. Haddock. Swampscott; C. P. Curtis.

The public are cautioned against all similar brackets, not marked with my stamp, as such brackets are infringements of patents held by me.

Also cedar-top riding-saddle bracket. Price $3.50 each. An whip-rack for English coach and straight whip combined. Price 50 cents each.

JAMES J. READ, 13 Tremont Row, Room 10.

A. G. NEWMAN, late NEWMAN & CAPRON.
MANUFACTURERS OF
Fine Bronze Hardware, Bank, Office and Stoop Railings in Bronze or Brass. Antique Furniture-Trimmings. Electrical and Mechanical Bell-Hanging Burglar-Alarms
Warerooms, 1180 BROADWAY. Factory, 157-163 WEST 29th STREET, NEW YORK, N. Y.